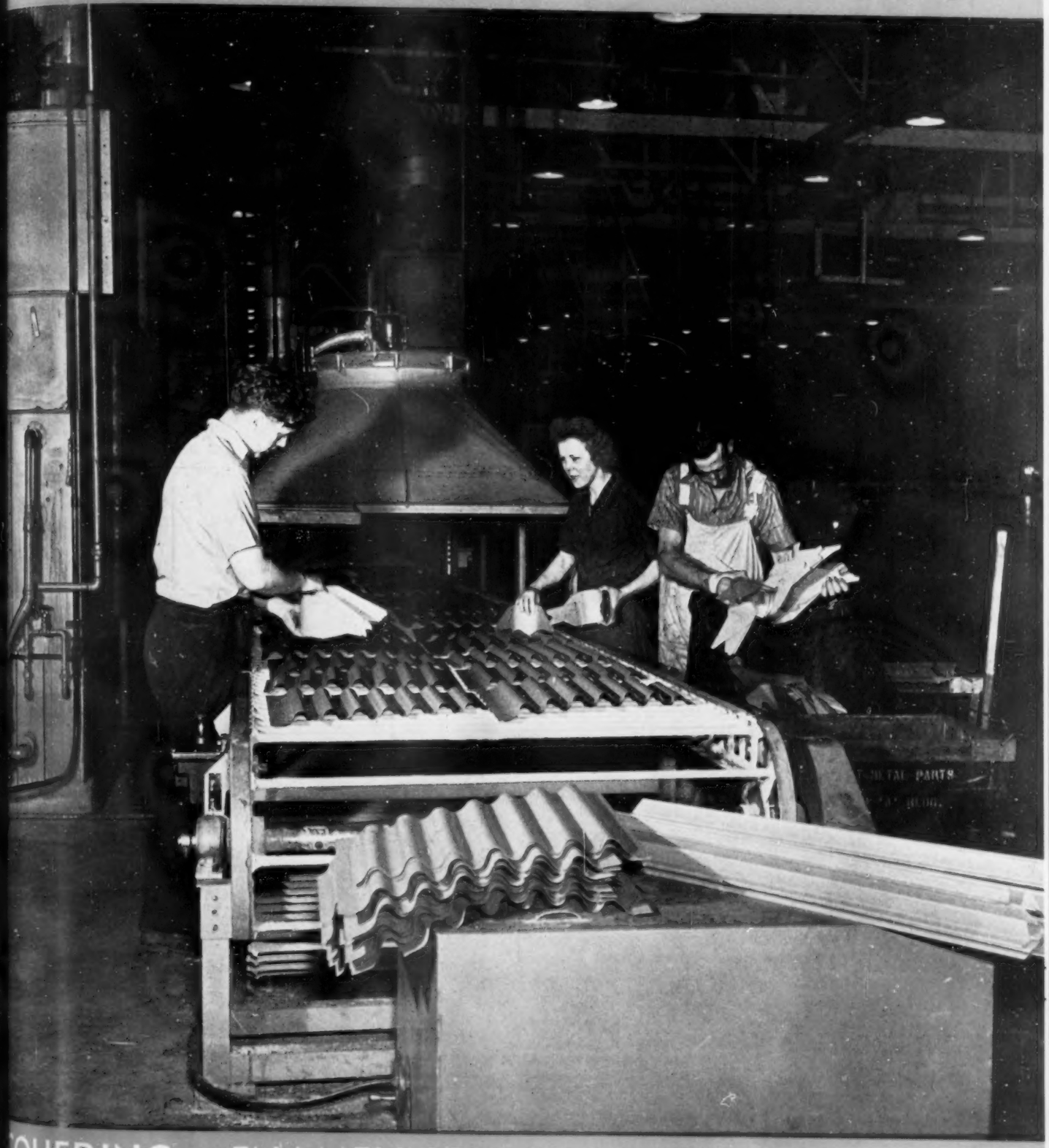
NOVEMBER, 1942

ORGANIC FINISHING

SECTION OF METAL FINISHING



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ORGANIC FINISHING

SECTION OF METAL FINISHING

NOVEMBER, 1942

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Drying Oils

The situation on natural drying oils is critical and will probably remain so until the end of the war. The use of the drying oil, tung oil, has been further restricted under amended order M-57 of the WPB. After November 1st, specific authorization of the director is required to use tung oil except for users of 35 pounds or less a month.

The domestic production of tung oil is only a fraction of our needs. To make matters worse, the situation on oiticica oil is also bad due to the failure of the Brazilian crop. The use of this oil is also restricted under amended order M-57.

Much development work has been going on in an effort to create drying oils from more available non-drying or semi-drying oils. These developments include de-hydrated castor oil and specially treated linseed oil. Unfortunately, castor oil is not freely available and very high priority ratings are required for its use.

Treated linseed oils are still available without priority and in regard to one brand of treated linseed oil, it is interesting to note that the product is claimed to polymerize practically as fast as tung oil and that hard, glass-like coatings can be produced by overnight drying.

Small amounts of new drying oils have been located in Africa but these supplies are practically negligible in quantity.

Some discussion has been raised as to whether it would be practical to try to modify babassu palm oil for use as a drying oil. Like cocoanut and other palm oils, babassu has an idoine number of only 15 and thus in itself is completely non-drying. Therefore it would not be practical to attempt to synthesize a drying oil from it since many other oils, such as cottonseed oil, are more readily available.

L. H. LANGDON, *Publisher* • T. A. TRUMBOUR, *Business Manager* • DR. WALTER R. MEYER, *Editor*

THIS IS WASHINGTON—

By George W. Grupp
METAL FINISHING's Washington Correspondent

Alcohol On October 8, 1942 the Nation's distilled spirits plants turned over their entire capacity to produce annually 240,000,000 gallons of industrial alcohol which is needed to make smokeless powder and butadiene.

Chemical Transportation Chairman Donald M. Nelson of the WPB recently issued a Certificate of Necessity to the Office of Defense Transportation which sets forth priority regulations on the shipment of commodities in tank cars. A rating of "B" was given to 390 different chemicals such as acetone, acetyl chloride, aluminum acetate, arsenic acid, benzene (benzol), bronzing liquids, calcium chloride, carbon tetrachloride, caustic soda, chrome chloride solution, core compound, cresylic acid, enamel, hydrochloric acid, lacquer, paint, shellacs, varnish, and zinc chloride.

Containers Branch Personnel Changes During the month of October a number of changes in personnel took place in the WPB Containers Branch. W. W. Fitzhugh, president of William W. Fitzhugh Incorporated, Brooklyn, N. Y. was made Deputy Chief of the Branch. R. S. Solinsky, president of Cans, Incorporated, Chicago, Illinois, was made Chief of the Metal Can and Tube Section. Roswell C. Mower, vice president of the Manz Corporation, Chicago, Illinois, was made a Special Assistant to Charles L. Sheldon, Chief of the Branch.

Container Substitutes Urged The Office of Price Administration on October 14, 1942 notified the chemical industry that it will not grant an upward revision of prices to permit manufacturers to use containers made of critical materials except in special and unusual cases. This action was taken to not only support WPB's Limitation Order L-197, but it was also done to encourage the substitution of cheaper containers.

Fats and Oils The users of fats and oils in the making of lacquer, paints, varnish and other protective coatings were granted an 80 per cent quota, and linoleum, oil cloth, oil or oleoresinous coated fabrics and pyroxylin coated fabrics producers were granted a 70 per cent quota, by General Preference Order M-71, as amended September 22, 1942. The Order granted a blanket exemption to manufacturers who use less than 6,000 pounds of fats and oils in any calendar quarter.

Copyrights of Enemies Seized Some of the copyrights of scientific and technical works that are owned by citizens of the Axis powers which were recently seized by the Office of Alien Property Custodian are Beilstein's "Handbook of Organic Chemistry"; Fritz's "Luminescent Pigments"; and the works of others.

Furnace Type Carbon Black Because of a shortage of furnace type carbon black, this commodity was placed under allocation control by the issuance of General Preference Order M-244, dated October 16, 1942. Applications for authorization to accept delivery must be made on Form PD-600; and those seeking to make delivery must file Form PD-601. Delivery, purchase and use of 100 pounds or less furnace type carbon black in one month are exempt from restrictions.

Lacquer Use Restricted To finish joining hardware for burial vaults, caskets, and shipping cases, only one coat of nitrocellulose lacquer may be used, according to General Limitation Order L-64, as amended September 24, 1942. The Order permits the use of lead in liners for gaskets and for soldering in the making of such burial supplies.

Oiticica Oil Due to the Brazilian oiticica nut crop failure, oiticica oil, a substitute for tung oil, was placed under strict control beginning November 1, 1942 by General Preference Order M-238, dated October 6, 1942. Applications to consume, use or process oiticica oil must be made on Form PD-600 on the 15th of the month preceding the month of authorization.

Paint, Varnish, Lacquer Committee The Paint, Varnish and Lacquer Industry Advisory Committee, which was recently appointed by the WPB, consists of E. H. Bucy of the WPB; Walter M. Clark, Muralo, Incorporated, Staten Island, New York; O. J. S. de Brun, Egyptian Lacquer Manufacturing Company, New York City; W. D. Gilman, Gilman Paint & Varnish Company, Chattanooga, Tennessee; Franklin J. Lane, Boston Varnish Company, Boston, Massachusetts; Paul R. Croll, Pittsburgh Plate Glass Company, Pittsburgh, Pennsylvania; E. M. Flaherty, E. I. du Pont de Nemours & Company, Wilmington, Delaware; Robert F. Jaegle, Jaegle Paint and Varnish Company, Philadelphia, Pennsylvania; M. J. Merkin, M. J. Merkin Paint Company Incorporated, New York City; Oakley Paint Company, Los Angeles, California; Edward H. McIver, Leland-Moore Paint and Oil Company, Charleston, South Carolina; McMurtry Manufacturing Company, Denver, Colorado; H. S. Margetts, W. P. Fuller & Company, San Francisco, California; Frank Sulzberger, Enterprise Paint Company, Chicago, Illinois; and A. W. Steudel, Sherwin-Williams Company, Cleveland, Ohio.

Paint, Varnish & Lacquer Survey Herbert Wachsmann, an industrial assistant in the OPA accounting Division was granted a leave of absence to make a war materials survey of the paint, varnish and lacquer industry for the National Paint, Varnish and Lacquer Association.

Pyroxylin & Vinyl Resin Committee The WPB has announced the appointment of a Pyroxylin and Vinyl Resin Coated Paper and Fabric Industry which is made up of L. E. Carpenter, L. E. Carpenter & Co., Newark, New Jersey; Frank V. Friedlander, C. R. Whiting Company Incorporated, Hackensack, New Jersey; Robert A. Harper, Holliston Mills, Incorporated, Norwood, Massachusetts; F. J. McCormick, Permatex Fabrics Corporation, Jewett City, Connecticut; W. E. Masland, Masland Duraleather Company, Philadelphia, Pennsylvania; Walter V. Shearer, The Plastic Coating Corporation, Holyoke, Massachusetts; F. F. Sommers, Chicago Rubber Clothing Company, Racine, Wisconsin; J. K. Weidig, Zapon-Keratol Company, Stamford, Connecticut, and E. H. Bucy of the WPB.

(*Concluded on page* 626)

Coating by the Electric Spray Method*

By HAROLD RANSBURG

Harper J. Ransburg Co., Indianapolis, Ind.

This paper describes a unique achievement in organic finishing. By means of an electrical field it is possible to prevent overspray and to direct the spray particles uniformly over the work. Thus a saving in finishing material is effected as well as the obtaining of a uniform coat even on very irregular objects. An electrical method is proposed for removing heavy films of finishing material on the edges of work coated by dipping. This eliminates need for subsequent patching, shortens the baking schedule and permits faster evaporating solvents to be used in the dipping finishing material. The processes are applicable to the finishing of both conductive and non-conductive materials.—Ed.

EVERYONE is familiar with the orthodox method of spray coating, and to a certain degree, to its possibilities and limitations. The purpose of this discussion is to describe an entirely different method of applying coatings to articles, which has been developed within the past few years and has been very successful in largely overcoming two of the most serious handicaps of spray finishing. The process accomplishes these very worthwhile purposes by causing a large saving in material waste and contributes toward a more uniform film than can be achieved by any ordinary means.

Fundamentals of the Process

There are a number of similarities and a number of dissimilarities between this painting process and conventional electroplating. In the use of this process, the grounded article being coated is surrounded by an electric field. It is designed to impart an electric charge on the sprayed particles in such a way as to cause the particles to be attracted to the piece being coated. The proper electric current is provided by a power pack which is especially designed to produce a high voltage (on the order of 100 K.V.) and a very low amperage (not exceeding 10 milliamperes).

Direct current is essential, although fair results can be had with almost any rectified wave form. Our tests have established the fact that a pulsating one half wave is as satisfactory as any, and appreciably more efficient than some other wave forms. The volume of current used is negligible and in no case do we anticipate the use of more than four or five milliamperes on the secondary. It is important, however, that a sufficient amount of current be supplied to the electrodes, and this end can be accomplished on any installation by properly designing the "lead-in", carrying the current from the power pack to the electrodes, so as to mitigate the leakage from the "lead-in" conductor.

The electrodes which surround the grounded article are designed of sharp points or fine wires. These are properly spaced from the piece and from each other in such a way as to produce the proper intensity and direction of impulse to the field established. It is essential that the aggregate ratio of surface area of the electrodes be very, very small when compared to the area of the article directly opposite the electrodes. However, when carrying this principle to the extreme, a noticeable decline in efficiency has been found.

The general rule which we have established for practical applications is that we use a series of No. 30 copper wires suspended vertically and spaced ten to twelve inches from each other with the entire electrode structure eleven inches from the piece. This has been found to be the most suitable set of conditions when working with 100 K. V.

Guns and Spraying

The guns that we use are of a standard make, air operated automatic type which have been selected for their ability to atomize liquids sufficiently when using a relatively low air pressure. The conditions of the paint and air pressure vary considerably with the type of article being coated and the speed of production required. However, it can be said in general that we have obtained our most satisfactory results when using about ten pounds atomizing pressure and in the neighborhood of one pound of fluid pressure.

The fact that these pressures are not fixed should not imply that there are wide limitations upon these factors, but it is important to realize that as we vary the flow of the liquid to meet the requirements of a specific job, we must also vary such factors as the fluid tip size, the atomizing pressure, and the fluid pressure, in order to attain the greatest efficiency.

This might be more clearly understood by a realization of the importance of correlating the inertia of the paint particle with the intensity of the electric field through which it is moving.

The position of the spray guns is somewhat determined by the specific application, but in all cases where a high savings of material is desired, it is imperative that the axis of the spray be directed at an acute angle to the line of travel of the pieces on the conveyor. We normally use an angle of fifteen degrees. This factor is highly important because of the wide variety of particle sizes produced from any spray gun we have tested. It is obvious that a varying time will be re-

* Presented at the 30th Annual Convention, American Electroplaters' Society, June 8-10, 1940.

quired for the field to overcome their original inertia and direct them to the article being coated, since they vary in size and inertia at a given distance from the gun head.

In most cases, it is highly practical for the spray gun to remain in continuous operation. The pieces pass progressively through the field, each picking up its share of coating material. In cases where it is impossible to have an uninterrupted flow of articles through the coating zone, it is easily possible to use an electric eye or a timing relay for actuating a magnetic air valve which will in turn operate the guns.

Applicable to Most Finishing Materials

The paint required for this process is in no way different from that used in general finishing practices. This fact has been determined by very extensive tests, and we know without question that the difference between materials considered highly insulating, and those considered highly conductive is so slight as to be neglible. However, it is necessary that the solvents be adjusted so that the film remains open a little longer than normal usage would require. This can be obtained by a number of rather simple changes in the present formula of dilution in the paint supply room. To illustrate, we have very successfully used 40% E— #3 and 60% E— #2 for diluting material which would be normally reduced with toluol or E— #1. High boiling point solvents may be used, such as 1% of pine oil or a small percentage of butyl carbitol. The viscosity is reduced considerably below that in normal practice in order to secure the maximum in particle size and low velocity.

Films Normal

The film resulting from this application is in no way different from that acheived by other methods other than the fact that it can be expected to be much more uniform in thickness.

One of the most striking demonstrations we have designed is one where we suspend a grounded object about two feet before a spray gun and spraying directly at it for a period of three seconds. Of course, the result is that the side of the piece directly facing the spray gun is well coated and all of the paint spray which does not contact this narrow surface continues beyond the piece and is lost. Then we replace this object with an identical one and with all other conditions the same, we surround the piece with an electric field and repeat the operation. The results in this case are rather startling, in that the observer can see a paint spray travel past the piece, change its original course of travel by 180 degrees and return to the back side of the piece being coated. This serves to illustrate our ability to completely coat a piece on top, bottom and all sides without changing its position. Though an interesting operation to observe, there are few production applications where it is practical to spray from one side only without rotating the piece if both sides are to be coated.

Not Limited to Conductive Materials

This process is not limited to articles made of conductive material. We have found that we can produce very efficient results on both wood and pottery.

We have coated over one million pottery flower pots by this method and have found that on this item, we are able to reduce our paint consumption to one fifth the amount required when spraying by hand. We have considerable evidence to encourage our belief that on items such as refrigerators, we will be able to reduce the paint consumption by 40%. We have conducted production runs with porcelain enamel on stove panels and are convinced that we can save thirty percent of the material used on cover coat in the stove industry. The degree of savings possible is largely controlled by the shape and size of the piece being coated.

There are a few limitations to the use of this process which would be well for us to note. As in electroplating, protruding edges and recessed sections are difficult or impossible to coat uniformly. This does not mean that the piece must be perfectly smooth but rather it can be thought of as an obstacle toward getting the maximum in uniform film thickness. A considerable volume of repetitive production is necessary before it is practical to install the highly specialized equipment required for this method.

Detearing Process

Another process which we have developed has proven highly beneficial to the application of liquid coatings by dipping. This process is designed to automatically and economically remove the "fatty edges" and excess material from the "drain-off" point of pieces that have been dipped. We know that this process will be of extreme importance where it is of interest to eliminate the "fatty edges" so prevalent on dipped pieces.

In applying it to production, the pieces are first dipped and allowed to drain until the flow of material has substantially ceased. This period of flow-down depends entirely upon the shape and size of the piece and the flowing characteristics of the coating material. However, in most cases, between two and three minutes is sufficient period to accomplish the desired results.

At this point it is passed over electrodes on which there is a high potential (in the neighborhood of 60 K. V.) between the electrodes and the grounded piece. The electrodes are flat shets and designed to attract the excess material from the piece. The length of time required in the electric field will vary somewhat upon such factors as the radius of the section from which the paint is being removed, the condition of the "fatty edges" at this period, and the intensity of the field at the "drain-off" point. When conditions are favorable, a few seconds are sufficient to remove a proper amount of excess material.

The power pack built to supply the proper current to the field will produce about 80 K. V. and is so designed that it cannot produce more than 5 milliamperes on the secondary.

This process will be most valuable where it makes possible the dipping of pieces that would have to ordinarily be sprayed. It makes possible a wider range in the formulation of dipping materials, (such as using urea which normally would blister). The paint chemist can formulate without regard to "fatty edges" or "tears". In many cases this will make possible a shorter bake schedule. It will eliminate the costly and unsatisfactory practice of "cutting off" and patching the areas around "drain-off" points. In some cases it makes possible the use of faster solvents and more viscous coating material, so that a more nearly complete hiding may be obtained in a single dipping application.

This process is limited to the use of materials which do not have a sufficient thermalplasticity to cause a reformation of "tears" or "fatty edges"

during the bake. It is also necessary that the "drain-off" point be of relatively small radius in order to obtain a highly satisfactory appearance in the paint film at the point from which the excess was removed.

This process is not limited to materials normally considered conductive. We have processed many pieces of pottery, wood, rubber, bakelite, and glass, and have applied insulating coatings such as high dielectric varnishes, latex, wax, as well as the normal types of organic finishes.

At our plant in Indianapolis, we have facilities for testing various articles and for demonstrating the effectiveness of this process and would be happy to devote our time, experience and equipment toward improving the methods of coating any war products.

Shop Problems

Problem 3. Adjusting Solids Content

Problem: It sometimes happens that the source of supply of thinner for particular finishing material is nearer to the user than to the manufacturer of that material. In such instances it is often the practice to manufacture the finishing material at greater than ordinary solids content in order to save shipping charges on the thinner. The high solids material is adjusted to the proper solids content by the user at his plant rather than at the plant of the paint manufacturer.

The following is an example of the calculations which are involved in determining how much thinner must be added to a finishing material of high solids content to produce a specified lower solids content.

A baking synthetic enamel weighing 12.0 pounds per gallon is received at 60.0 per cent solids by weight. How much thinner must be added to each gallon of the high solids enamel to reduce the solids to 25.0 per cent? The thinner weighs 6.85 pounds per gallon.

Solution: Since the enamel weighs 12.0 pounds per gallon and contains 60.0 per cent by weight of solids, each gallon contains $12.0 \times \frac{60.0}{100} = 7.2$ pounds of solids and $12.0 - 7.2 = 4.8$ pounds of volatile solvents. Now, to produce a material containing 25.0 per cent solids with the 7.2 pounds of solids, $\frac{7.2}{25.0} \times 100 = 28.8$ pounds of volatiles are needed. However, in the original gallon of high solids enamel there were 4.8 pounds of solvents and therefore $28.8 - 4.8 = 24.0$ pounds of thinner are required to produce a solids content of 25.0 per cent. Since the thinner weighs 6.85 pounds per gallon, 24.0 pounds equals $\frac{24.0}{6.85} = 3.5$ gallons of thinner.

Next month: Aluminum Content.

Airpainting Unit

The Paasche Airbrush Company, 1909 Diversey Parkway, Chicago, Ill. have issued a bulletin describing their new turntable automatic airpainting unit. The bulletin gives specifications and shows the units in 24" and 36" diameter sizes.

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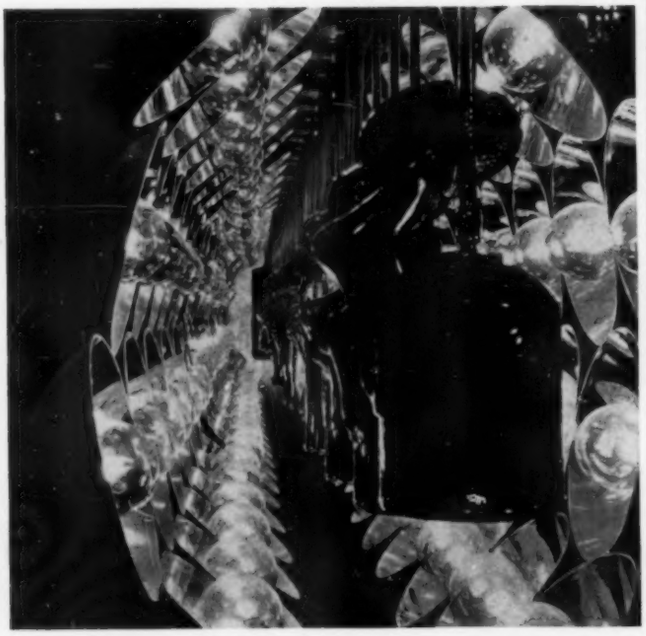

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NEWS FROM WASHINGTON

(*Concluded from page 620*)

Steel Shipping Drums — Amendment No. 1 to Limitation Order L-197 provides that "On and after October 1, 1942, no person shall manufacture or complete the manufacture of any drum which shall not have the letter X plainly and legibly embossed on the bottom plate thereof." WPB's Container Branch has declared that Limitation Order L-197 does not prohibit the use of steel drums in shipping lacquer. The paints covered by that Order are dry powder paints and water type paste paints.

Titanium Pigment Advisory Committee — The recently appointed WPB Titanium Pigment Industry Advisory Committee is made up of E. H. Bucy of the WPB; Paul E. Sprague, American Zirconium Company, Cleveland, Ohio; John Allegaert, United Color and Pigment Company, Newark, New Jersey; J. F. Daley, E. I. du Pont de Nemours and Company, Krebs Pigment Division, Wilmington, Delaware; and D. W. Robertson, Titanium Pigment Corporation, New York City.

Tung Oil — Specific authorization is required to use tung oil in quantities in excess of 35 pounds a month beginning November 1, 1942 as ordered by General Preference Order No. 57 as amended October 6, 1942. Applications for delivery and use must be made on Form PD-600.

Vinyl Acetate Under Allocation — On November 1, 1942 vinyl acetate was placed under complete allocation control by General Preference Order M-240, dated October 8, 1942. Form PD-600 must be used for delivery requests; and Form PD-601 must be filled out by distributors in making their report to WPB.

Vinyl Resins Producers Committee — The Vinyl Resins Producers Industry Advisory Committee recently appointed by the WPB consists of H. S. Bunn, Carbide & Carbon Chemicals Corporation; L. F. Loutrel, Shawington Products Corporation; John C. Brooks, Monsanto Chemical Company; A. E. Pitcher, E. I. du Pont de Nemours & Company, Incorporated; J. R. Hoover, The B. F. Goodrich Company; Bradley Dewey, Dewey & Almy Chemical Company, Incorporated; W. C. Goggin, The Dow Chemical Company; Henry B. Townsend, General Latex and Chemical Corporation, and Frank H. Carman, of the WPB.

Rapeseed Oil — Because of restricted shipping facilities, rapeseed oil was restricted further by General Preference Order M-77, as amended October 6, 1942. Like tung oil and oiticica oil, application to consume, use or process must be made on Form PD-600 on or before 15th of the month preceding the month of authorization.

Solvent Price Changes — Due to market conditions, Amendment No. 2 to Maximum Price Regulation No. 36, dated October 3, 1942, fixed the maximum price of fermentation acetone at 7.0 cents a pound in tank car lots; 8.5 cents a pound in carload lots in drums; and 9.0 cents a pound in less than carload lots in drums. Amendments No. 2 to Maximum Price Regulation No. 37, dated October 3, 1942, set the maximum price of normal fermentation butyl alcohol at 14.25 cents a pound, and normal fermentation butyl acetate at 14.75 cents a pound.

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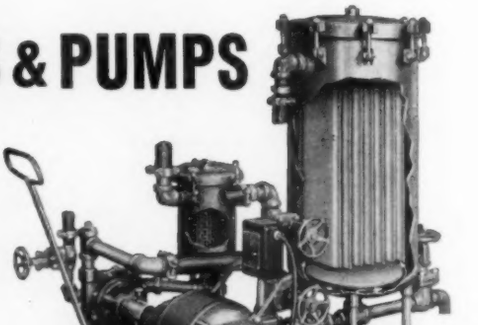

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A Dipping Questionnaire

By FRANK J. MANNING
New York, N. Y.

The author has prepared a series of questions and answers on dipping which will be of value to those who are interested in learning about this method of finishing. As pointed out in one of the answers, dipping is economical of finishing material, an extremely important factor these days when every gallon must be used to best advantage.—Ed.

Question. What factors enter into applying organic finishing materials by dipping?

Answer. Among the more important factors are: the rate at which the article being finished is withdrawn from the finishing material; the manner in which the article is suspended; the viscosity, specific gravity and surface tension of the finishing material; the evaporation rate of the solvents in the finishing material.

Question. Does a slow dip produce better results than a rapid dip?

Answer. Within limits, the slower the withdrawal rate, the better the results obtained. A slower dip usually produces a more uniform film and fewer drips.

Question. All other factors considered, which is better—a thin dipping material or a heavier, more viscous one?

Answer. A higher viscosity is usually preferred, especially for pigmented materials. Pigment suspension is often not as good in finishing materials of low viscosity as in those of higher viscosity, and settling of heavy pigments or floating of light pigments may occur. Such settling or floating can produce off-color or streaked work.

Question. Can the rate of dipping be too slow?

Answer. If an article is withdrawn too slowly from the finishing material, poor finishing sometimes results, particularly if the material is of the rapid drying type. Unless the withdrawal is extremely smooth, the material tends to dry in parallel ridges. The withdrawal rate should be at least fast enough to allow the finishing material to flow to a smooth film before it sets.

Question. Isn't it possible to get more production in a shorter time with a faster dip?

Answer. In many instances no advantage is gained by rapid dipping. Because a rapid withdrawal from the tank drags out so much finishing material, a period must be spent in waiting for the piece to drain. This time could be used for a slower withdrawal.

Question. Is rate of immersion of the piece to be dipped important?

Answer. Yes, it is. Rapid immersion usually causes air bubbles to be formed. These air bubbles may be withdrawn with the finishing material on the piece and, when they burst, cause blotches on the finish.

Question. Should withdrawal begin immediately after the piece is immersed.

Answer. It is good practice not to begin withdrawal as soon as immersion is complete. A short period should be allowed so that the finishing material may completely wet the surface of the piece being dipped.

Question. If it is desired to use a slower withdrawal rate, what adjustment of the finishing material must be made?

Answer. All other things being equal, a slow withdrawal rate produces a thinner film than a more rapid one. To compensate for the slower withdrawal rate, unreduced finishing material is added to the dip tank. Such an addition increases the viscosity and solids content of the material and allows a less rapid withdrawal.

Question. How does the specific gravity of a finishing material affect dipping?

Answer. The greater the specific gravity of a finishing material, the thinner the film which may be obtained by dipping. This is only reasonable since a heavy finishing material would have a greater tendency to drain off than a light one.

Question. When thinner is added to a finishing material, is the decrease in specific gravity which results very important?

Answer. As thinner is added to a finishing material, its dipping characteristics are not changed so much by the change in specific gravity as by the change in viscosity and solids content. The specific gravities of the average finishing material and its thinner are often such that the change produced by mixing the two is comparatively small. For all practical work, the effects of added thinner on the specific gravity of a material may be disregarded.

Question. Is an hydrometer or a viscosimeter more satisfactory for controlling dipping materials?

Answer. As pointed out above, the specific gravity of a finishing material is not as important as its viscosity. Furthermore, since a given addition of thinner does not affect the specific gravity as much as it does the viscosity, it may be said that a viscosimeter is the better instrument to use.

Question. What is the best way to hang an article for dipping?

Answer. Articles to be dipped should be suspended so that all sections drain freely, that is, so that there are no reservoirs to catch and drag out material from the tank. All surfaces should be slightly inclined and the suspension should be such that the finishing material drains to a single point.

Question. How often should the viscosity of a finishing material in a dip tank be checked?

Answer. It is extremely important that the correct viscosity of a dip finishing material be closely maintained once it has been determined. Viscosity should be checked before work is begun and at least once every hour while the material is in use. Finishing materials gain in viscosity due to the loss of solvents by evaporation and thinner must be added periodically to make up this loss if good dip finishing is expected.

Question. May more than one coat of a finishing material be applied to an article by dipping?

Answer. Successive coats of finishing materials which cure by chemical change may be applied with no particular difficulty. Finishing materials which dry by evaporation of the solvents sometimes cannot be dipped more than once because the first coat is attacked by the solvents in the wet finishing material.

Question. Must finishing materials be specially designed for dipping?

Answer. Some finishing materials are specifically formulated for dipping and may or may not be suitable for different means of application. Others may be applied by more than one method by using more or less thinner or a thinner of different type. Whenever dipping is considered, the finishing material supplier should be asked for his recommendations. The type of reducer has an important bearing on the "flow-out" characteristics.

Question. Skinning of the finishing material in a dip tank sometimes occurs when it is not used for a period as, for example, over week-ends or between production runs. How may this be avoided?

Answer. Skinning may be minimized by using a cover over the tank and by pouring a thin layer of thinner on the surface of the material. Blanketing the surface of the material with a layer of carbon dioxide gas has also been used to prevent skinning.

Question. Is agitation of the finishing material in a dip tank necessary?

Answer. Clear finishing materials may not require agitation but pigmented types usually do to prevent settling of pigments. A simple propeller agitator may be used although a better if somewhat more expensive system is constant recirculation.

Question. How much finishing material is lost by dipping as compared with other methods of finishing?

Answer. Dip finishing, properly done, allows almost complete utilization of finishing material. There are, of course, solvent losses due to evaporation. However, valuable solids are not wasted and dip finishing is usually conceded to be more economical of material than some other methods of finishing.

Question. Does dip finishing have any disadvantages?

Answer. Dipping is not the perfect method of finishing and it does have its disadvantages. Certain shapes cannot be dipped easily. Dipping cannot be used to finish only one side of an article. Dipping equipment is not as flexible as, for example, spraying equipment.

Question. Must the finishing material in a dip tank be filtered?

Answer. Because dip tanks pick up dust and dirt, it is good practice to filter the finishing material. Filtering can be intermittent but continuous filtering is much to be preferred. If a constant recirculation system is used it is relatively easy to insert a filtering device in the line. Such a filter assures a clean, dust and dirt free material and good results.

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Permit Painting of Assembled Planes at Southwest Bomber Plants

ONE of the many unusual features of two recently completed mammoth bomber assembly plants in the Southwest is the provision made at each plant for a paint spray structure large enough to permit the painting, after complete assembly, of the huge bombing planes turned out by the plants.

No paint spray buildings of equal size have ever before been constructed. At each plant the enclosure in which the assembled planes are painted is 150 feet wide, 200 feet long and 35 feet high. A partition which can be lowered from the ceiling to the floor makes it possible to divide the enclosure into two sections, each large enough to handle an entire plane.

The size of the enclosure at each plant, however, is less remarkable than the ventilating system which was designed to provide a means of exhausting the paint laden air, and replacing it with washed and filtered air. Such a system was required both to protect those handling the spray nozzles from spray and fumes, and to eliminate the fire and explosion hazard.

High Paint-Air-Water Ratio

The ventilating problem was solved by designing a system which draws 700,000 cubic feet of air per minute from the outside atmosphere, washes it, warms it, filters it, draws it across the enclosure in an even flow, washes out the pigment, and exhausts the air into the outside atmosphere again. There are eight air supply units and eight exhaust units.

For every pound of paint sprayed, there is supplied 5250 pounds of air and 6466 pounds of water. This is about five times the paint-air-water ratio of comparable commercial installations. It takes a crew of six men about two hours to paint a plane. Twenty-five gallons of paint are required.

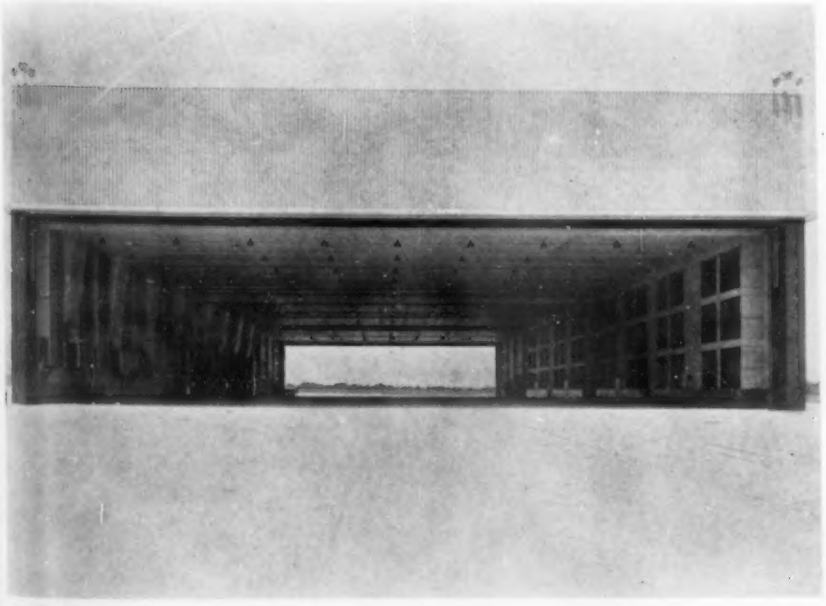

Fig. 1. View through the enclosure, with end doors rolled up to permit entrance of bombers. The air filters through which the air enters the enclosure are at the left; the exhaust units at the right.

Supply Units Mounted In Roof Trusses

All equipment for the air supply units is mounted in the roof trusses, taking fresh air from near the roof line. Fans draw the air in through automatic inlet louvres. After being tempered by steam coils, washed, and re-heated to a constantly controlled temperature of 80° F., the air is evenly distributed over the entry wall through a system of dampered ductwork.

Admission of the air into the spray enclosure is then made through replaceable glass fiber air filters. These filters consist of mats of fine, interlaced glass fibers coated with a dust-catching adhesive. Their function is to strain out any particles of dust or pollen that may remain in the air stream. They are arranged in 16 vertical bay panels, each containing 57 filter cells. Each cell provides room for 4 filters. Thus 3,648 filters are employed to strain the air entering the enclosure.

The ductwork and filters are so arranged that the clean air enters the enclosure in such a way as to provide an evenly distributed flow from side to side, from floor to ceiling. The overspray from the paint spray guns is carried horizontally by the flow of air from the point where it is produced, across the width of the enclosure, to the nearest exhaust opening at the opposite side. The lighter overspray has no opportunity to settle in traversing the enclosure.

Exhaust Units Help Maintain Even Distribution

The eight exhaust units are arranged to draw the air out at three levels, thus helping to maintain even distribution. Each section of each unit has a constant flow of water over its flood sheet, the surface exposed to the room.

A suction-draft exhaust fan, located outside of each unit, draws the paint-laden air through a series of conical, high-pressure water sprays, confined in

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circular orifices. Centrifuge tubes completely separate the water and sludge from the air and deposit them in a sludge tank below. Only clean air passes through the exhaust ducts and fan.

The sludge tank for each unit holds 2000 gallons of water. The water in these tanks is continuously re-circulated through the units by pumps mounted on the floor in the spaces between them. The only loss of water is from evaporation. Water spray nozzles are in plain sight and readily accessible. There are no concealed eliminators that require removal for cleaning.

Water Sprays and Filters Present Fire Barriers

Should a fire be generated within the enclosure it would be impossible for it to pass through the water sprays and spread through the exhaust system. The glass fiber filters through which the clean air enters at the opposite side of the enclosure do not support combustion, and would tend to act as a barrier to fire spreading into the supply system. Further, the dust-catching adhesive with which the glass fibers are coated, carries underwriters' approval as a material without smoke or fire hazard.

The entire system is controlled by electric push buttons within reach from the paint floor level. Each of the supply and exhaust units is independently controlled. Any combination of the units can be operated together. Automatically controlled dampers on both the supply and exhaust units close when a unit is shut down and open when it is started up again. When no painting operations are in progress, but the outside temperature requires heat in the structure, about 10 per cent of the capacity of the supply air is drawn in through one unit to hold a working temperature. The ventilating systems for the paint spray enclosures at the two bomber plants are practically identical. Both systems were designed, fabricated and installed by the R. C. Mahon Company, Detroit. Owens-Corning Fiberglas Corporation, Toledo, supplied the glass fiber air filters. The plants, including the paint spray structures, are of "Ferroglas" construction, developed jointly by The Austin Company, Truscon Steel Company, and Owens-Corning Fiberglas Corporation. Glass fiber material is used throughout the walls and roofs as thermal insulation.

Corrosion Prevention of Magnesium Alloys & Aluminum Alloys

U. S. Pat. 2,289,006 P. F. George, assignor to The Dow Chemical Co., July 7, 1942. The corrosive attack on aluminum base and magnesium base metals by an aqueous fluid in contact therewith is retarded by adding to said fluid an alkaline water-soluble metal salt of a beta-glucoside derived from a succulent plant in a proportion sufficient to retard corrosion.

Example: Sodium chrom glucosate.

Organic Coating

U. S. Pat. 2,293,558 R. L. Overholt, assignor to E. I. duPont de Nemours & Co., August 18, 1942. A highly adhesive and scratch-resistant priming composition comprising polyvinyl butyl aldehyde resin, cellulose nitrate and shellac in the proportion by weight of up to about 42 parts of shellac and at least 58 parts of polyvinyl butyraldehyde resin and cellulose nitrate in the proportion by weight of about 65 parts of polyvinyl butyral resin to 35 parts of cellulose nitrate and 25 parts of polyvinyl butyral resin to 75 parts of cellulose nitrate.

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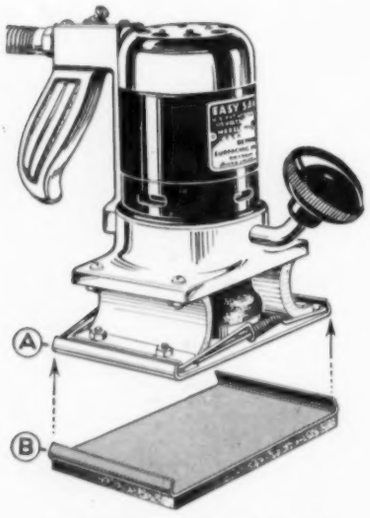
New Equipment

Electric Sanding Machine

Detroit Surfacing Machine Company, 7433 West Davison Street, Detroit, Mich., have announced their new Model XLD reciprocating electric sanding machine.

A unique feature of this model is its bottom plate which is detachable to permit rapid change of one type or size pad to another. The use of special plates for specific jobs is advised and these are available with pads of sponge rubber, felt or composition in widths from 1 in. to 3¾ in. and thicknesses ranging from ¼ in. to 1 in.



Reciprocating Electric Sander

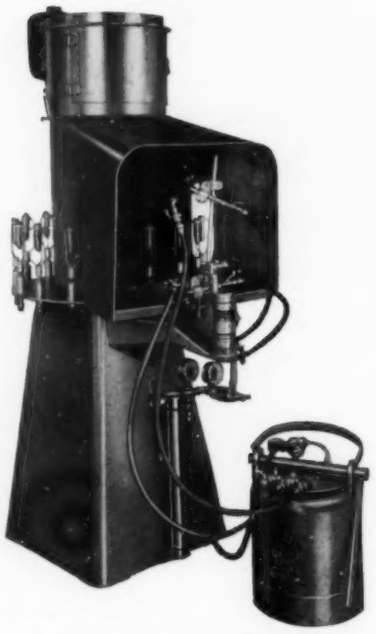
The reciprocating action of this machine is recommended for the production and maintenance of curved or flat wood, metal, plastic or composition surfaces, either wet or dry. Its applications include sanding, rubbing, and polishing of airplane parts, gliders, propellers, guns, searchlights, ammunition cases, etc.

The Model XLD weighs 7½ lb. and is easy to operate. Power is furnished with a heavy duty Universal electrical motor in either 115 or 230 volt models.

Detroit Surfacing Machine Co. will supply descriptive literature and application recommendations for specific types of work upon request.

Automatic Airpainting Unit

The Paasche Airbrush Company, 1909 Diversey Parkway, Chicago, Ill., have developed a new turntable, automatic airpainting unit. An improvement over the company's older type unit, this one has all its drive mechanism fully enclosed in dustproof housing, new type automatic air brushes and a built-in access door to its ventilating system which obviates the use of an access sleeve. Another advantage of this unit lies in its compactness and in the minimum of floor space it occupies.



Automatic Air Painting Unit

Painting Machine for Four Pound Incendiary Bomb

The DeVilbiss Company recently announced the development of a two and three station machine for the painting of exterior and interior surfaces of the component parts of the M54 four pound incendiary bomb.

The body of this bomb consists of two parts—a cylindrical tube which contains the charge and a tall, hexagonal tail assembly which contains the detonating mechanism. After these metal parts are made, but before they are sent to an ordnance plant for loading and assembly, both their interior and exterior surfaces must be painted. The charge container is coated on the inside with acid resist black and on the outside with zinc chromate primer. The mechanism casing is coated inside and out with the primer only.

The machine consists of a fully automatic spray station for exterior painting, one or two semi-automatic spray stations for interior painting, and a chain-on-edge spindle-type conveyor.

After the cases are placed on the workholders of this machine, they move into the first spray station where, as they are rotated, their exterior surfaces are automatically painted. Then, without stopping, they pass over a section of the conveyor which is sufficiently long to provide a five minute drying period.

Fully dry for handling, the bomb body components reach the unloading station where they are removed from the workholders, two at a time, and placed on the stands in the semi-automatic spray stations. Then, moving extension guns automatically coat their interiors.

A production rate of 2,000 pieces per hour is maintained when the machine has a conveyor length of 25 feet and is provided with two semi-automatic spray stations for interior painting. A production capacity of 1,000 units per hour is obtained by the elimination of one semi-automatic spray station and by a suitable reduction in the speed and length of the conveyor. A production rate of 600 pieces per hour is secured by a still further reduction in the conveyor's speed and length.

Rubbing Compound

Formax Manufacturing Company, 3985 18th Street, Detroit, Mich., have issued a folded leaflet on their new hand rubbing compound. The leaflet describes the four-fold function of the compound and lists the prices of the various sizes of can available.

Infra-Red

The Fostoria Pressed Steel Corporation, Fostoria, Ohio is the publisher of a 32-page manual describing the near infra-red process.

This fully illustrated booklet reviews the war-time applications of infra-red as a baking, drying, heating and dehydrating expedient, and shows photographs of various installations in leading industrial plants.

NEW BOOK

National Paint Dictionary. By Jeffrey R. Stewart. Published by the Stewart Research Laboratory, 1340 New York Avenue, N. W., Washington, D. C. 1942. Size 9¼" x 12¼"; 224 pages; Price: $7.50.

The second edition of this valuable book has much information added. The material is arranged alphabetically with cross references for the various names of products and processes. It contains definitions of materials, equipments, processes and testing procedures used in the finishing industry. Both technical and trade names are included. However, in almost all cases, the owner of the proprietary process or material described is not given and we believe future editions should contain this information.

The book is printed on good paper with a very readable type and ample illustrations are used throughout the text. Of value, too, are the charts and tables appended. Among these charts and tables are found those for temperature conversion, physical properties of oils, atomic weights, tank capacities, color identification, tests for pigments, fire extinguisher liquids, radiation and pH data, bulking factors and sales statistics.

Spray Gun

U. S. Pat. 2,297,497 M. Popoff (Germany). In possession of Alien Property Custodian. Sept. 29, 1942. A spray gun for paint and lacquer containing, in addition to the atomizing jet, an accelerating jet to increase the discharge velocity of the liquid after atomizing.

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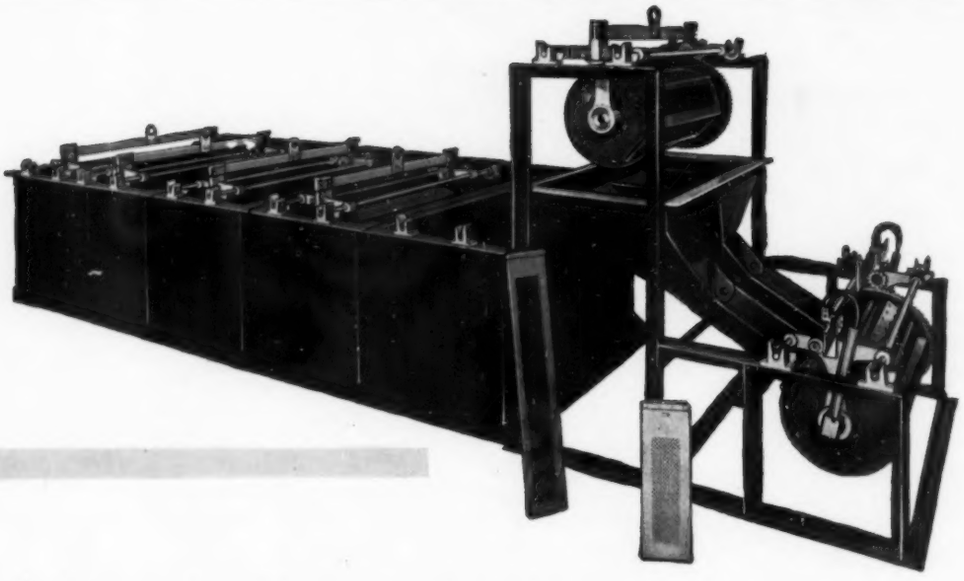

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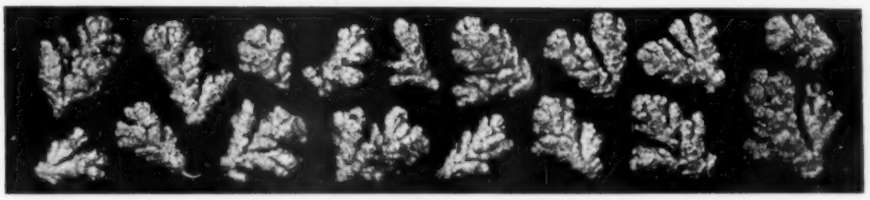
DECEMBER, 1942



Chromium Nodules

SCRAPE FOR SCRAP

ONE section of our industry has the good fortune to end the year in a particularly advantageous position, considering the general shortages of raw materials. We speak of chromium plating which uses important quantities of chromic acid, a chemical made from a low grade chromium ore unsuitable for the production of ferrochrome and, as a result, under no serious governmental restrictions.

The chromium plater has dug down into his collection of old plating racks, anode scrap and miscellaneous odds and ends, adding his findings to the sorely needed national scrap pile, as have all patriotic citizens. In too many cases, however, he has missed the opportunity to make a contribution of far more importance to national defense.

Chromic acid is fairly readily available but metallic chromium is high on the critical list. Although the acid has a chromium content of 52%, it has not appeared feasible to extract the metal for the use of the steel maker. The chromium plating plant, however, can be a source of significant amounts of chromium if the trouble is taken to segregate and save chromium peelings and the nodules which form on plating racks, dummies, current thieves and on the projecting parts of articles receiving heavy chromium deposits.

The quantity recovered by any one plater at one time may be so small as to raise the question of the advisability of saving it. Nevertheless, the rapidity with which these nodules and peelings accumulate will probably be surprising and if the large number of chromium plating plants is taken into consideration, it can be seen that although the contribution of a single plant may be small, the aggregate will be impressive.

The material, if sorted and cleaned, will run as high as 95% chromium. To overcome the objection that bothering with a few pounds would be expensive, we might point out that it will bring a return of as much as 40 to 45 cents per pound to the plater, which will more than pay for the labor. This return, which often will be almost 20% more than the plater has paid for the metal content of his chromic acid, can be compared with the return a nickel plater receives for his peelings and nodules—often 90% *less* than what he paid for nickel anodes.

We strongly urge that all chromium platers save their chromium peelings and nodules and when a reasonable quantity, such as 100 lbs., has been accumulated it should be boxed and shipped to a converter immediately.

The Effect of Copper on Hot-Dip Zinc Coatings*

By WALLACE G. IMHOFF

President
The Wallace G. Imhoff Company
Vineland, New Jersey

The available evidence indicates that a small copper content will increase the corrosion resistance of hot-dip zinc coatings. Research engineers are constantly striving to improve the quality of their product. Even as it is, there is no substitute as good as, or better than a hot-dip galvanized coating to protect iron and steel against corrosion, but this industry has never been satisfied to believe that nothing is left to do in the field of research, to see if it is possible to obtain a still better hot-dip zinc coating. It is with this constant idea of always searching for ways to improve the product that the writer wishes to focus thought upon a little known subject, namely, the effect of very small copper additions to the zinc coating with the idea of improving its corrosion resisting qualities.

IT is only natural that the question, "What grounds are there for such a belief?" should suggest itself. The answer to this question is found in submitting the available evidence on the subject. The evidence alone might not be enough to arouse any suspicion that such is the case, but when the available evidence is reviewed with a background of practical iron and steel melting practice, and a wide practical knowledge of zinc smelting and hot-dip galvanizing, suspicions are aroused that copper in zinc coatings will perhaps improve their corrosion resistance in the same proportion as copper in small amounts has done to steel. The ideal galvanized product, therefore, from the stand-point of corrosion resistance, should be a product that has a copper-bearing steel base metal, a copper-bearing zinc coating, and highly skilled technical galvanizers to put the zinc coating on the base metal correctly. That condition of producing the superlative galvanized product from the standpoint of corrosion resisting standpoint, therefore, must obtain all three of these factors. At present there are only two, a copper-bearing steel base metal and expert galvanizing practice in applying the coating.

Copper in the Base Metal

In his report,[1] "The Corrosion of Copper-Steel Fence Wire," Oliver W. Storey states:

1. It has been definitely established that the durability of old steel fence wire is due to the presence of copper.
2. Manganese does not increase the corrosion of steel, and its absence does not decrease the corrosion.
3. The copper in the early steel and wrought irons came from the copper-bearing ores of the eastern United States and imported ores. The proportion of copper-steel made, decreased with the increasing importance of the copper-free Lake Superior ores.
4. Steel fence-wire containing copper is as durable as wrought iron.
5. Present-day steel fence wire usually does not contain copper and therefore corrodes rapidly.
6. Under ordinary atmospheric conditions, zinc corrodes more slowly under conditions favoring rapid corrosion of iron, and vice versa, iron corrodes more slowly under conditions favoring rapid corrosion of zinc.
7. The life of fence wire is dependent upon the quality both of the galvanized coating and iron or steel base. Since the galvanizing is usually thin, the life of the fence depends principally upon the iron or steel base, which should be highly corrosion resistant. From the above conclusions it would appear that a fourth condition must be added to give the superlative zinc coating, and that in addition to the small copper content suggested, namely that as heavy a zinc coating as is practical should also be applied.

D. M. Buck[2] in his paper on "Research on the Corrosion Resistance of Copper Steel" states the following conclusions—

"Copper increases the resistance of steel and iron to atmospheric corrosion. Its influence is apparent when the copper content reaches 0.03 per cent. Its effect is almost at a maximum when the copper reaches 0.05 per cent. 0.25 per cent copper has been chosen as the best amount for commercial steel. Steel containing 0.25 per cent copper outlasts "Pure Iron" containing 0.05 per cent copper.

Steel containing 0.05 per cent copper lasts as long as "Pure Iron" containing 0.05 per cent copper.

The influence of copper is probably due to its control of the sulphur.

Sulphur in steel accelerates corrosion very markedly.

Sulphur oxides in the air accelerate the corrosion of steel.

Copper in steel counteracts or retards both corrod-influences."

In an issue of *Wire and Wire Products* the following interesting article is given on the life of some early wire—"In 1859, Bee's Wire Grapevine was started between Placerville and Old Virginia City, Montana. It was completed in 1861. It is of more than passing interest to stop and examine the chemical composition of this wire. It was found to be a very pure wrought iron, remarkably free from impurities such as carbon, manganese, sulphur, and copper. Its composition is given below—

	%
Carbon	.014
Manganese	.056
Sulphur	.028
Copper	.037

Evidently the copper in this wire has been more beneficial than suspected in so far as prolonging its life is concerned.

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* Reprinted from WIRE AND WIRE PRODUCTS *17*, 391 August, (1942).

The references are in abundance testifying to the value of small additions of copper to the base metal to increase its resistance to corrosion. Many references to all this scientific work were published by the American Sheet and Tin Plate Company, Pittsburgh, Pa.

Vital Points About Copper in Steel

This discussion is not on copper in the base metal, but it has been absolutely necessary to give some discussion to this phase in order to round out the whole discussion, and more particularly to call attention to one conclusion which states, "The influence of copper is probably due to its control of the sulphur." As a practical steel melter, the writer soon learned that "an oxidized heat" almost always was high in sulphur, and that the slag not only contained much sulphur but also the molten steel. As it escaped it could easily be recognized by its choking sulphur smell.

Another important statement of Storey's which should not be overlooked is "Manganese does not increase the corrosion of steel, and its absence does not decrease the corrosion." Here again as a practical steel melter, the significance of this conclusion must be explained, as it too has a definite bearing on the discussion later on. Both copper and manganese take up the sulphur in steel. Good steel is always made in the furnace, and not in the ladle. It is for this reason that many of the finest steel melters always add Spiegel iron to the bath about one-half hour before tapping the heat. The addition of the Spiegel which contains manganese just a short time before tapping the heat is for the purpose of cleansing the bath of both oxygen and sulphur; oxygen in the form of manganese silicate and sulphur in the form of manganese sulphide. In addition to this the steel itself is also cleansed, and the melter looks for his olive green "velvety slag" as the practical indication that the melt is in fine condition to tap.

Modern steel making practice appears to have eliminated this fine practice of adding Spiegel to the furnace about a half an hour before tapping.[4] Demands of more and more production have evidently assumed that the same effect can be obtained quickly in the ladle, as was obtained by slow "simmering" for a half an hour in the furnace before tapping. The change of melting practice is not a point for discussion here. The point of vital interest is that both copper and manganese additions are beneficial because they tend to cleanse the steel of both oxygen and sulphur. How this is accomplished could also be the subject of another paper on steel melting practice.

Zinc Also Contains Sulphur and Oxides

The writer has purposely avoided any discussion on steel melting practice since that is a matter of each melter's opinion. Turning now to zinc we find that a large part of the zinc is obtained from "Black Jack," or "zinc blend," zinc sulphide. In Wisconsin it is found with the lead ore "galena-lead sulphide."

The ores are put through separators and then the sphalerite is roasted to reduce the sulphur, after which it is further reduced in zinc retorts in the zinc smelters. Even the highest quality slab zinc still contains some sulphur. The writer has a vivid recollection in melting down some slab zinc in one galvanizing pot, of the yellow sulphur that had condensed on the outsides of some of the slabs.

Also in melting down the metal in the galvanizing pot and during galvanizing operations, oxides and inclusions in the zinc occur just the same as oxides and inclusions in steel. Thus if small additions of copper to steel are beneficial, it would seem logical that with the same impurities, sulphur and oxides, that the addition of a very small amount of copper to the molten zinc bath (galvanizing bath) should be beneficial in cleansing the bath, and also in adding to the corrosion resisting qualities of the zinc when small amounts of copper are found in the zinc coating.

Metal and Alloy Additions to the Galvanizing Bath Difficult to Understand

The reason that there is so little information in the galvanizing literature as to the relative merits of adding copper to the galvanizing bath, is because so little is known about actually what does happen, and what is the effect of making many different metal and allow additions to the galvanizing bath. The writer has discussed metal and alloy additions to the galvanizing bath in the American Metal Market[5] and in Metal Cleaning and Finishing[6] so that that very complicated subject can only be referred to in the light of copper additions to the galvanizing bath, and the influence of copper in zinc coatings.

A very thorough search of the literature has not revealed a single instance where any definite research work has been done in which actual tests were made on the failure and life of zinc coatings without any copper content, and zinc coatings with a copper content. This should be an extremely interesting, practical, and fertile field for the American Society for Testing Materials on which to conduct some careful research investigations. The tests should be made to study the difference in corrosion resistance of zinc coatings without copper, and zinc coatings with copper.

The base metal in the tests should also be an ordinary steel without copper, and a steel base with copper. It can at once be seen that a number of practical combinations can be made up for the tests, such as, for example, a base metal without copper with a zinc coating with copper, vs. a base metal with copper and a zinc coating without copper; or a base metal without copper with a zinc coating without vs. a base metal with copper and a zinc coating with copper.

Many additional variables can be devised, in addition to still another variable the weight of the zinc coating on the base metal. Such research work is a long and tedious problem and to obtain full accurate results the tests should be made by such a recognized authority as the A.S.T.M. Many copper-bearing base metal test results are available, but no mention in most of them is made as to the actual chemical analysis of the zinc coatings protecting the base metal. It is assumed that all of these zinc coatings are non-copper-bearing zinc coatings. The same tests with copper-bearing zinc coatings might show a considerably longer life, and much greater corrosion resistance.

Available Knowledge About Copper Bearing Zinc Coatings

In reviewing the literature in search of all available information of practical interest and value to the galvanizer, we find that the field of discussion must be divided into a number of different distinct phases. These distinct phases are: (a) copper in zinc; (b) copper in the galvanizing bath; (c)

TABLE I—ANALYSES OF REMELT ZINCS

Copper	*Tin*	*Lead*	*Iron*	*Cadmium*	*Zinc*
.84	1.27	2.28	.09	.13	95.39
.13	...	.53	.09	.13	99.22
...	.56	.98	.05	.72	97.69
.396	.505	1.87	.303	.373	Balance zinc
Trace	.15	1.50	.24	...	" "
Trace	1.00	1.40	.43	...	" "

copper in galvanizing pots; (d) copper in zinc coatings; (e) the effect that copper has on the corrosion of zinc coatings; and (f) copper in galvanizing by-products—1. dross, 2. oxide skimmings, and 3. sal-ammoniac skimmings.

(a) Copper in Zinc

It is recalled that the copper content in the early irons was said to be derived from the iron ores. Thus if we find any copper in slab zinc we should expect it to come from zinc ores. According to the "Data of Geochemistry,"[7] eleven zinc ores are listed, and not one shows any copper content. However Schnabel[8] states the following:

"Copper was found by Eliot and Storer in New Jersey zinc. Zinc from Missouri was found to contain 0.0013 to 1.1123 per cent copper, and 0.0002 per cent was found in zinc from Upper Silesia. Karsten found that ½ per cent of copper makes zinc harder and brittle—so much so that it showed ragged edges on rolling, and could not be rolled without cracking."

According to H. E. Brauer and W. M. Peirce,[8] "If copper is present in zinc in a very small quantity it seems to have a protective effect." A most valuable and enlightening statement on the subject comes from a paper by C. H. Mathewson, C. S. Trewin, and W. B. Finkeldey.[9] They state, "Even the most promising metal, copper, appears to be considerably less soluble in solid zinc than the figures quoted above would indicate; we have been unable to introduce much more than 1½ per cent of copper into solid solution in zinc. There is hardly enough copper present in the alloy used in the tests just described (1 per cent) to alter its mechanical properties to any great extent. One per cent of copper in zinc does not greatly modify the metal; it requires some 10 to 20 per cent to produce a marked change in properties."

The examination of a couple of hundred analyses of various brands of zinc used for galvanizing does not in any case reveal more than a trace of copper. Thus for all practical purposes it may be stated that there is no copper of any significance in ordinary slab zinc for galvanizing. Since the ores contain no copper this is what would be expected.

The writer has found copper in various quantities in remelt zincs.[10] It is stated in this reference, "Metallic copper is not commonly present in commercial grades of zinc. The alloying elements are usually lead, iron, and cadmium. Sometimes present, but in much smaller amounts are tin, arsenic, antimony, and bismuth. Traces of copper are found in electrolytic zinc. According to the New Jersey Zinc Company, the zinc lattice will hold between 1.5 and 2.0% of copper in solid solution depending on the temperature. The presence of copper in solid solution hardens zinc to some extent but does not affect the rolling properties adversely."

"Prime Western" zincs do not contain copper but remelt zincs which are at times used in hot galvanizing do contain small amounts of copper as illustrated in Table 1.

Thus it may be stated that standard Prime Western slab zinc does not contain copper, and that even in remelt zincs, the copper content is shown in six cases to be under 1%, with 5 out of 6 zincs containing under 0.4% copper.

(b) Copper in the Galvanizing Bath

The first question is how can copper get into the galvanizing bath. The answer is in the zinc, in metals and alloys added to the galvanizing bath, and third, by deliberately putting it in. The first item, "in the zinc" has just been covered. The second item, "in commercial alloys added to the bath," we find that the chemical analysis of an addition commonly made to the galvanizing baths, shows a copper content of 0.044 per cent. This as seen is very little. The third item, "by putting in deliberately," has been described by the writer in reference[10] which is the following:

"The alloying action of the galvanizing bath upon copper is illustrated by the analysis of a bath where a few small copper tubes had been galvanized. A ladle full of zinc lifted from the kettle showed the following chemical composition:

	%
Zinc	98.66
Lead	0.93
Copper	0.015
Iron	0.043
Aluminum	0.004
Cadmium	0.350

"Only the purest prime western metal was used in this pot and the copper contents of the bath were derived solely from the attack of the molten zinc at galvanizing temperature upon the copper tubes which were put through the bath. This is, of course, a very small percentage of copper."

The same reference[10] discusses a test made on "Everdur," a copper alloy of the following composition:

Chemical Composition of "Everdur"

	%
Copper	94.76
Silicon	4.13
Manganese	0.74
Phosphorus	0.06
Iron	0.04

"The results of these tests conclusively show:

1. It is not practical to try to zinc coat 'Everdur.'
2. Copper alloys are readily attacked and dissolved by molten zinc at galvanizing temperatures.
3. The lag screw not only lost weight by galvanizing, but the molten zinc attacked and destroyed the threads.

TABLE II—COMPOSITION

Fe	*Sn*	*Pb*	*Cu*	*Sb and Al*	*Zn*
			Per Cent		
3.7	0.10	0.80	0.90	not detected	95.31
3.5	.70	.72	.06	" "	95.02
3.2	.22	.71	.05	" "	95.82
2.7	.08	.82	.02	" "	96.38
3.1	.73	.81	.02	" "	95.34

4. The zinc coating did not adhere well to this alloy."

In one other example, the writer watched the smile come over a practical galvanizer's face when he tried to hot-dip galvanize a light copper wash boiler, and finished with just the top hoop band of the tub in his tongs. Finally for test purposes and experimental purposes the writer has deliberately added small quantities of sheet copper to the galvanizing bath to study the effects of copper in various quantities in the bath.

The writer has records of at least two practical galvanizing baths which carry copper, both of which companies were purchasing "remelt" zinc for their pots. A range boiler and tank galvanizing bath had the following chemical composition:

	%
Zinc	98.66
Lead	0.93
Copper	0.015
Iron	0.43
Aluminum	0.004
Cadmium	0.350

A pipe galvanizing bath that came under the writer's supervision, and which was supplied with "remelt" zinc for metal additions, showed the following analyses:

	%	%
Lead	1.02	0.96
Iron	0.13	0.11
Tin	0.11	Trace
Cadmium	0.11	0.04
Copper	0.02	Trace
Aluminum	None	0.04

At this time it is of interest to call attention to the fact that not in a single one of these galvanizing plants was any objection ever offered in regard to the zinc coatings for any cause, and that includes the copper content in the baths.

(c) *Copper in Galvanizing Pots*

The question also in this connection of copper in zinc coatings has brought up another one of interest which is—How does the copper content of steel affect the destruction of the galvanizing pot? Firebox steel and flange of boiler rivet steel are the standard materials from which hot-dip galvanizing pots are made. It is, therefore, of much practical interest to hear what Mr. R. J. Barrow, Secretary of The Columbiana Boiler Co., Columbiana, Ohio, has to say on the subject. In a personal letter to the writer Mr. Barrow states:

"The general analysis of galvanizing pot steel is as follows:

	%
Carbon	0.15 Max.
Phosphorus	.04 "
Manganese	.40 "
Sulphur	.05 "
Silicon	.02 "

"As to the copper content of the steel," Mr. Barrow states, "We believe that the time is opportune for the study of the merits or the detrimental effect of copper content in galvanizing kettle steel. We have found that a copper content of 0.06 to 0.08% has not been harmful in one case. However, the popularity of copper-bearing steel in industry causes us to believe that some steel may be high in copper and we do not know what effect that would have. We believe that very few copper tests have been run on galvanizing kettle steels and you may be interested in that point."

From the information we have available there is no doubt that a very small copper content in galvanizing pot steel is not harmful. On the other hand as can readily be seen, there is a point at which the copper content would actually greatly accelerate the pot destruction. Where and what point this is in copper content can only be discovered by actual tests of losses by hanging samples of pot steel with varying copper contents into the galvanizing bath. Just off hand and with no data or facts other than what we have available it is the writer's opinion that this copper content must be kept under 0.5% at least. It is believed that higher copper content would actually accelerate pot destruction.

(d) *Copper in Zinc Coatings*

It is really very surprising on making a very thorough search through the technical literature on corrosion, how much data and information are available on copper bearing steels, and how little information and discussion and technical facts there are available on copper in zinc coatings. Even today the information and data are so scarce that almost no definite, conclusive statements can be made as to the service that small additions of copper in zinc coatings perform.

Rawdon in his book, "Protective Metallic Coatings,"[11] gives the chemical composition of some commercial hot-dipped zinc coatings on sheet iron and steel. The table is given below. Special attention is called to the copper content in the zinc coatings as shown in Table II.

In discussing Table II, it is interesting to note that Rawdon does not mention the copper content in the zinc coating. He states, "The results summarized in Table 3 show the composition of the coating on five different commercial zinc-coated sheets of American manufacture. According to these results, none of the manufacturers had used aluminum but all the coatings contained nearly the same amount of lead. Tin had evidently been used intentionally by at least three of the five."

In searching through hundreds of references there is much information available showing that copper-bearing steels are the most resistant to corrosion. However, in almost every case, the chemical analyses refer to the base metal, and even when there is a zinc coating on the copper-bearing steel, no reference is made to the chemical composition of the coating, and of course no special reference to the copper content of the zinc coating, if it does carry any copper.

The actual analyses of zinc coatings are few, and there is almost no information at all especially in regard to the copper content of the zinc coating, or galvanizing bath. It is really amazing to find so very many technical articles have been written on copper-bearing steels as a base metal for galvanizing sheets, and yet in every single reference consulted there was not a single analysis given for the zinc coatings on any of the copper-bearing sheets used in the tests.

It is the writer's opinion that almost as great an improvement will be found in adding copper to the zinc for zinc coatings in small amounts, as has been found in adding copper in small amounts to steel. In other words, the best corrosion resistant galvanized sheet would be a copper-bearing steel base, with a coating of copper-bearing zinc, with the heaviest zinc deposit consistent with perfect performance of purpose, and put on with the very best possible sheet galvanizing technique. The copper-bearing zinc coating should give a longer zinc coating life than a plain zinc coating, and the copper-bearing steel base has al-

ready been proven superior in corrosion resisting qualities over the plain steel base.

(e) The Effect that Copper Has on the Corrosion of Zinc Coatings

In view of the fact that there is almost no available information on this subject, items here and there in the literature will be cited to determine which way the direction points in regard to the value of copper in zinc coatings as a factor of corrosion resistance. We find some most valuable hints in some references of Brauer and Peirce.[8] They state, "Copper to the extent of 0.5 per cent is a powerful retarding agent and in any amount up to 5 per cent is more or less beneficial." This statement is made in reference to its influence on oxidation. Again in the same reference we find the statement, "The pure zinc-aluminum alloy showed considerable corrosion. In alloys containing small quantities of copper, corrosion had just become visible."

Also, "The harmful effects of lead, cadmium, tin, and iron, respectively, as well as the beneficial action of copper, etc., etc." and then finally in the summary we find much of interest which is quoted below:

First—it is seriously accelerated by the small amounts of lead and cadmium, which may be found in many grades of zinc.

Second—it is accelerated by tin.

Third—nickel and manganese have a slight accelerating effect on the rate of corrosion.

Fourth—it is materially retarded by small percentages of copper.

Additional information on copper-zinc alloys is given by W. M. Peirce in his paper, "Studies of the Constitution of Binary Zinc-Base Alloys."[12] An amount of 1.50% copper is given for copper in solid solution.

In regard to the corrosion of zinc in the atmosphere, in a Bulletin, "Rolled Zinc,"[13] under the heading of "Rate of Corrosion in the Atmosphere," we find the following comments—"The variations in composition among commercial grades of zinc have not been shown to have any important effect on the rate of atmospheric corrosion, although there is some evidence that lead tends to decrease the corrosion somewhat. Certain zinc alloys containing elements not normally found in commercial grades of zinc show an even lower rate of corrosion than the commercial grades." It is possible that the authors have in mind alloys containing copper, although they do not mention this fact.

Perhaps one of the most valuable references for throwing light on the subject is that given in "Galvanizing," a book by Heinz Bablik,[14] page 310. He states, "The importance of the purity of the zinc is thus demonstrated very clearly; whereby it must be remembered that already, a hundred years ago, de la Rive ascertained that the solubility of zinc in acids increases in the order—distilled water, zinc with tin, zinc with lead, zinc with copper, commercial zinc." The only question here is whether zinc with copper in it is better than commercial zinc. Tests and experiments made by much later investigators that have already been cited in references seem to indicate that zinc with copper in it is superior in corrosion resistance to commercial zinc. This would change the order of the de la Rive series and place commercial zinc before zinc with a small copper content.

On page 41 of "Zinc and Its Corrosion Resistance,"[15] published by The American Zinc Institute, we find the following: "The potential series of metals with regard to their susceptibility to corrosion by water, as determined by measuring their solution pressures, was reported by Weston to be as follows: aluminum, zinc, iron, nickel, lead, tin, and copper." Thus alone we find copper is excellent in its corrosion resistance to water. There is therefore no reason to believe that additions of small amounts of copper to the galvanizing bath, should do anything other than increase, or add to the corrosion resistance of the zinc, rather than accelerate its destruction.

On page 56 of the same reference[15] we find, "If copper is present in zinc in a very small quantity it seems to have a protective effect." And on page 65 of the same reference[15] we find, "The protective effect of a small amount of copper on the corrosion of zinc is reported by Prost, who states that a small quantity of copper seems to have a very protective effect."

Rawdon,[11] on page 77 of his book, states, "Antimony in amounts from 0.03 to 0.07 per cent seemed to have accelerating effect on corrosion, whereas small amounts of copper, even a few hundredths of one per cent, appeared to exert a protective action." Burns and Schuh,[16] page 101, state substantially the same as Rawdon in regard to the effect of copper.

Some very interesting light is thrown on the matter by Sir Robert Hadfield in his paper, "A Practical Trial of Roofing Sheets of Copper Steels and Other Materials."[17] We find the following on copper steels, "The trials concern galvanized sheets, both painted and unpainted, of the following materials: (a) Copper-bearing steels of two different names; (b) ingot iron; and (c) ordinary unalloyed sheets as currently employed. Copper-bearing steel is proving definitely superior to ordinary steel, but its merits did not appear until the galvanized coating had weathered off."

(f) Copper in Galvanizing By-Products

This item need only be treated very briefly. If the galvanizing bath contains any copper, the dross is bound to show the same amount since the dross is made up of zinc-iron alloy crystals with the bath frozen around them.

As to the effect of copper in the galvanizing bath on the skimmings, a few years ago the writer conducted some research work on a full-sized galvanizing bath in regard to the effect of small copper additions to the bath. Up to a certain point the copper simply dissolved and went into solution in the bath with no visible outward effects, and apparently no harmful results. However, there came a point at which the bath appeared to have taken up all the copper it could take up at galvanizing bath temperatures. This point was indicated by the appearance of a "red copper oxide smear" coming all over the finish of the zinc coating. It was clearly seen that no more copper could be added to the bath without destroying the galvanized finish appearance because of this "ugly red copper oxide smear."

Unfortunately at the time the tests were interrupted and the writer was taken away before getting a sample of the galvanized bath to see how much copper it had taken up. Even without an analysis of the bath the writer knows the copper content was extremely small, perhaps 0.1 of 1 per cent and not as high as 0.2 of 1 per cent. Only a few very small pieces of sheet copper were added to the bath before the red oxide danger signal appeared showing clearly that no more could be added without ruining the finish of the product. Nothing was ever heard in any way in regard to the quality of

(*Concluded on page* 660)

THIS IS WASHINGTON—

By George W. Grupp

METAL FINISHING's Washington Correspondent

Aluminum Scrap Tolling Excluded All written aluminum scrap tolling or conversion agreements approved by WPB were excluded from OPA scrap ceilings on October 23, 1942 in Amendment No. 3 to Aluminum Scrap and Secondary Aluminum Ingot Revised Price Schedule No. 2 as amended because such transactions are regarded as contracts to perform services and not as sales contracts. The fee which may be charged for such service is limited to the difference between the maximum converted price and the maximum scrap price.

American Magnesium Metals Co. Seized Alien Property Custodian Leo T. Crowley on October 23, 1942 announced the seizure of the property of the American Magnesium Metals Company of Pittsburgh, Pa. This company is a patent holding and exploiting company which was formerly controlled by the Austrian Magnesite Company, Limited.

Blackplate Containers Uses Restricted Beginning November 30, 1942 the packing of drying oils and varnishes in blackplate metal containers is restricted by Conservation Order M-136, Amendment No. 2, dated November 2, 1942. This amendment also provides that after December 15, 1942 resin-emulsion water paints, oleoresinous paints and oil paints must be packed in one gallon fiber bodied containers with blackplate ends.

Blackplate Order Amended Amendment No. 1 to Conservation Order M-136 issued on October 23, 1942 provides that cans made in part or wholly from chemically treated blackplate shall be used only for packing products listed in Table B of Tin Conservation Order M-81. The amendment also provides for 100 per cent of the 1941 usage of blackplate containers for packing lye in cans up to 13 ounces capacity. Blackplate may be used in limited quantities to pack dry solvents; printing, duplicating and lithographing inks, and hardened edibile oils, lards, rendered pork fat, and edible tallow.

Brass Foundries Cautioned H. O. King, Director of the WPB Copper Division, on November 17, 1942 cautioned brass mills, copper mills and brass and copper foundries that they must continue to use end-use classification symbols set up under Priorities Regulation No. 10 even though the allocation classification system has been abolished.

Brass Mill Products Committee The recently appointed Brass Mill Products Distribution Industry Advisory Committee of the WPB consists of T. M. Bohen, Whitehead Metal Products Co., New York City; H. V. Douglas, Central Steel & Wire Co., Chicago; Robert E. Grote, Metal Goods Corp., St. Louis; J. H. King, Vice President, Seaboard Brass & Copper Co., Baltimore; Walter Schroeder, Pacific Metals Co., Ltd., San Francisco; J. M. Tull, President, J. M. Tull Metal & Supply Co., Atlanta, and John W. Douglas, Chief, Industrial & Civilian Unit, WPB Copper Branch.

Arsenic Order Amended Because of a shortage of arsenic for defense purposes General Preference Order M-152 as amended October 21, 1942 provides that no person can accept or deliver arsenic except as specifically authorized by the Director General of Operations. Such authorization will only be granted after making application on Form PD-600 on or before the 10th of the month preceding the calendar quarter for which authorization is requested.

Army Contracts Audited By Field Staff The auditing of Army-plus-fee contracts by the General Accounting Office is now being done by field units in production areas instead of in the Washington office. This is to eliminate duplication of efforts, to reduce paper work, and to expedite payments to contractors.

Brass Mill Products Higher Rating Director General for Operations Ernest Kanzler on October 30, 1942 issued Amendment No. 1 to General Preference Order M-9-a, as amended August 1, 1942, which provides that warehouses dealing in brass mill and wire mill products are not permitted to deliver or sell such products except to holders of preference ratings of AA-5 or higher. Previous to this amendment they were permitted to sell to holders of ratings A-1-K.

Brass Prices Fixed In the issuance of Amendment No. 1 to MPR 202 on November 11, 1942 the OPA fixed the ceiling on special "trade name" brass and bronze alloy ingots, in carload lots, as in effect March 31, 1942, less 10 per cent.

Brass Mill Scrap Redefined The term "brass mill scrap" was re-defined in Amendment No. 3 to Revised Price Schedule No. 12 issued on October 23, 1942 by the Office of Price Administration. The new definition states that brass mill scrap "includes all kinds and grades of non-ferrous scrap materials which are a waste or by-product of any kind of fabrication of new sheet, tube, rod or other brass mill products. It also includes any unused sheet, tube, rod or other brass mill products sold to a brass mill for remelting whether such brass mill products are in the form originally sold by the brass mill or have been further fabricated, processed, altered or assembled." To this amendment "tinned copper" was added. The tinned copper prices were fixed at 9⅝ cents per pound for heavy scrap, sheet, tube, rod, and rod ends, and 9⅜ cents a pound was set as the ceiling for turnings.

Brass Products Inventories Investigated Inventories of stock brass and wire mill products in warehouses are being checked by the Compliance Division of the WPB with the assistance of Labor Department investigators for the purpose of determining violations of sales of copper and copper base alloys to customers whose orders are lower than A-1-k.

Rolled Gold Plate Prices Increased Sellers of rolled gold plate or gold-filled stock in the form of sheet, wire and tubing were authorized by Amendment No. 68 to Supplementary Regulation No. 14 to adjust their prices upward to the extent that their costs have been increased by the use of newly-mined domestic silver.

Brass Scrap Buying Eased The OPA's RPS 12, Amendment No. 4, dated November 13, 1942, provides that the buyers of brass mill scrap other than brass mills, ingot makers and copper refiners, may establish prices for specially prepared brass mill scrap with a letter rather than the formal order as provided under Brass Mill Scrap Revised Price Schedule No. 12.

Bronze Buyers Take Heed The Office of Price Administration has suggested that consumers of copper and copper alloy scrap who buy high-grade bronze, high-grade lead bronze and other formula priced grades of scrap in large lots at "cents per pound prices," should have inserted in their sales contracts a clause which states that if, after a chemical analysis of the lot bought, it is determined that the contract price is higher than the OPA, then only the OPA maximum price will be paid.

Cadmium Prices Fixed The Office of Price Administration established on October 21, 1942, in Order No. 6 under Maximum Price Regulations No. 204, the prices which the Metals Reserve Co. may pay to buy idle or frozen stocks of cadmium, f.o.b. plant of the Udylite Corporation, Detroit. The prices are: unused cadmium anodes (all shapes, including ball and patent shapes), 95 cents per pound; partially used cadmium anodes (all shapes, including ball and patented shapes), 94 cents a pound; cadmium pigs, bars, plates, sticks, pencils, rods, ingots, and all other regular straight or flat forms, 90 cents per pound; cadmium oxide (dry and properly packaged), 95 cents per pound, and cadmium scrap, 35 cents per pound of cadmium content.

Chemical Allocations For the month of November, 1942, the Chemical Division of the WPB allocated $50,000,000 worth of 56 different scarce chemicals such as naphthenic acids and naphthenates, n-butyl and secondary butyl alcohol, aqua and anhydrous ammonia, benzene, chlorine, furfural, methyl ethyl ketone, shellac, sodium nitrate, toluol, and vinyl chlorides. All allocations were made on the end-use basis.

Copper Control Continues Strict control over the use of copper in the manufacturing or plating of radiators, cooling control devices, electrical equipment, carburetors, gaskets, gauges, priming cups, clutch facings, and linings was continued by the issuance on November 7, 1942, of Supplementary Limitation Order L-170-a. At the same time Order L-26-c was revoked.

Controlled Materials Plan Chairman Donald M. Nelson of the WPB announced on November 2, 1942 a Controlled Materials Plan which has the approval of the Army, Maritime Commission, Navy, Office of Civilian Supply, and of representatives of consumers and producers goods. The chief objectives of the plan, which becomes effective in the second quarter of 1943, are (1) to adjust the supply of critical materials to requirements; (2) to make the quantity and kind of materials available at the time required for production purposes. This plan is creating a WPB materials bank because when this measure becomes fully operative, it will be impossible to get aluminum, copper, steel, and other materials without clearing through the WPB Requirements Board. All manufacturers and users of critical materials should get a copy of the booklet on the Controlled Materials Plan.

Copper Base Alloy Prices Order No. 5 under Maximum Price Regulation No. 204, dated October 19, 1942, authorizes the metal Reserve Company and the Copper Recovery Corporation to pay prices not in excess of the net prices paid by the holder of idle or frozen stocks of copper base alloy insect screening "plus 10 per cent of the net price, f.o.b. cars and trucks, or, if shipped by water, f.a.s. shipping point."

Copper for Construction Restricted Further The issuance of Supplementary Conservation Order M-9-c-4, as amended October 27, 1942, reduces to nearly zero the use of copper for building construction purposes. The amendment restricts the use of copper building products for repairs to 25 pounds or less provided the material was in the possession of the user on October 27, 1942. This amendment aims to prevent the purchase, sale, delivery and use of copper for installation in buildings in order that the Government may acquire and remelt the stocks of such products now in the hands of hardware stores, chain stores, warehouses, dealers, plumbers, contractors and others.

Copper Order Clarified Copper and Copper Base Alloy Building Materials Conservation Order M-9-c-4 as amended October 27, 1942, was clarified by Amendment No. 1 issued on November 18, 1942. The amendment merely corrects an ommission of several words in the Order issued on October 27, 1942 as it concerns the definition of the phrase "to install in or connect to a structure or system." The amendment restores the original intention of the Order as first issued.

Copper Inventories Prices In Order No. 8 Under Maximum Price Regulation No. 204 dated November 3, 1942, and to be effective as of August 20, 1942, the OPA fixed the maximum prices the Metal Reserve Company and Copper Recovery Corporation will pay for idle or excessive inventories of copper and copper base alloy products. Copper and copper base alloy products range from 15 cents a pound for certain copper wire to 30 cents for more expensive copper products, and from 14 to 28 cents a pound for copper base alloy products. The prices for copper or copper base alloy castings range from 18.05 to 19.75 cents a pound.

Copper Inventory Col. C. R. Baxter, U. S. A. Chief of the WPB Materials of Redistribution Branch revealed on November 12, 1942 that nearly 80,000 firms reported about 200,000,000 pounds of idle and excessive inventories of copper and copper base alloy products. Out of this total inventory the holders of 64,000,000 pounds have refused to sell, but the holders of 125,000,000 pounds have offered to sell their inventories. About 75 per cent of that offered for sale (93,000,000 pounds) has been already allocated to war production. War producers are urged to use the facilities of the Copper Recovery Corp., 200 Madison Ave., New York City, to fill their emergency shortages of copper.

Iridium Restriction Continued Conservation Order M-49 which restricts the use and sale of iridium in jewelry was to expire on November 30, 1942 but, Amendment No. 1 of Conservation Order M-95 issued on October 26, 1942, provides that the order shall continue in effect until revoked by the WPB Director General for Operations.

Kitchen Gadget Production Restricted Since November 23, 1942, Supplementary Limitation Order L-30-d, dated November 7, 1942, forbids the processing, fabricating, working or assembling of many kinds of metal kitchen gadgets, cooking utensils and houseware such as sink accessories, dust pans, silent butlers, crumb sets, wash boards and clothes wringers. This Order covers all items not included in Galvanized Ware Order L-30-a, Enameled Ware Order I-30-b, and Cast Iron Ware Order L-30-c. The Order does not include such items as basting spoons, cake turners, can openers, egg beaters, food choppers, food mills, wire strainers, butter cutters, dippers, French fry cutters, nutmeg graters, skimmers, sugar and flour scoops and vegetable graters

Export Restrictions The Board of Economic Warfare on November 6, 1942 placed all inventories of goods which bear brand names, labels, trade marks, and trade names of enemy countries under strict export regulation. A special license must now be obtained to export such goods.

Maintenance and Repair Ratings According to Amendment No. 2 to WPB Priorities Directive No. 2 dated November 3, 1942, all preference ratings assigned for maintenance, operating and repair supplies must now be approved especially by the WPB.

Office of Production Research and Development Dr. Harvey N. Davis, President of Stevens Institute of Technology, was appointed Director of the newly created WPB Office of Production Research and Development whose functions are (1) to provide the Chairman and WPB divisions and branches with information on research and development work conducted by the WPB; (2) to analyze and evaluate specific scientific or technological proposals; (3) to contract with outside laboratories for experimental work, and (4) to develop projects or processes which merit advancement.

Patent Seizures Some of the seizures of the Office of Alien Property which are of interest to *Metal Finishing* readers are these patents:

Number	*Title*
2,013,639	Apparatus for spraying liquids such as paints, varnishes, or the like
2,013,640	Method for applying coating liquids such as paints, varnishes and the like
1,574,966	Osmium alloy
1,576,005	Decomposing fats, oils and waxes
1,660,094	Process for the preparation of a new type of shellac substitute
1,660,159	Production of alloys of the platinum group
1,740,342	Recovery of sulphurous acid from waste gases
1,745,464	Process for the purification of metals
1,795,120 } 1,795,121 } 1,826,779	Process for the simultaneous absorption of ammonia and hydrogen sulfide from industrial gases
1,903,598	Shellac substitutes
1,909,215	Process for the manufacture of formaldehyde from methane
1,938,468	Process for preparing shellac-like resins from agatho-copal resins
1,967,649	Tasteless basic aluminum acetyl-salicylate and method for producing same
2,008,536	Process for the production of hydrogenated Benzo-Iso-Tetrazoles
2,025,616	Process for producing beryllium alloys
2,030,802	Method of catalytic oxidation of turpentine oils
2,030,921	Copper-beryllium alloys
2,062,130	Heat treatable nickel-beryllium alloys
2,123,330	Palladium alloys
2,134,241	Process for purifying crude hydrocarbons, more particularly crude benzol, crude benzine, and cracked benzine
2,149,257	Method for production of beryllium alloys
2,288,533	Process for the production of artificial resins
1,801,741	Method of reducing gypsum
1,705,128	Process of producing zinc
1,725,865	Method of producing metallic sulphates
1,728,681	Treatment of sulphide ores or sulphidic metallurgical products
1,966,627	Distillation apparatus for the production of zinc
2,007,332	or similar volatizable metals
2,000,140	Process for the distillation of zinc and similar metals.

OPA Reports Ruling To simplify the administration of Price Control, the OPA issued on October 19, 1942, Supplementary Order 23 which provides that reports which must be filed with the OPA need no longer be sworn to or affirmed.

Patent Specifications Soon Available Some time in December the Office of Alien Property will print and make available to the public at a nominal price all drawings and specifications of seized enemy owned patent applications. The OAPC is planning to place all enemy owned patents at the disposal of American manufacturers for the purpose of helping to win the war.

Platinum For Jewelry Banned All jewelry manufacturers were ordered to stop using platinum on November 2, 1942 by an amendment to Conservation Order M-162. The Order does not affect the sale of manufactured platinum jewelry in the hands of wholesalers and retailers. The Order permits the completion of all platinum jewelry in the process of production on October 31, 1942, but, the completion must be made before January 1, 1943. Polishing and the adding of stones may be made after the first of the year.. The WPB recommends that gold and palladium be used as substitutes for platinum.

Price Regulations Revoked The Office of Price Administration has decided to concentrate on improving its basic regulations and to give only limited consideration to individual ceiling price adjustments in the future. On November 15, 1942 Section 18(b) of the General Maximum Price Regulation and all similar sections in other price regulations were revoked, and on November 30, 1942 Section 18(a) of the General Maximum Price Regulation and all similar sections in other price regulations (except the service regulation—Maximum Price Regulation No. 165, as amended) were revoked.

Priorities Regulation No. 10 Revoked Priorities Regulation No. 10, which set up the Allocation Classification System, was revoked on November 5, 1942. Even though this system was abolished, the WPB's Copper Branch will continue to require end-use information from brass mills, copper foundries, and copper wire mills before it makes allocations.

PRP Offers Relief Those manufacturers who have urgent need for materials over and above the amounts authorized for the fourth quarter of 1942 under the Production Requirements Plan, may apply for additional supplies necessary on Form PD-25F for each class of product covered by the authorization on PD-25A. No application will be considered if it is not for materials needed for the war effort or for essential civilian needs.

Tin Can Scrap Control Interpretation No. 11, issued on November 10, 1942, on Supplementary Order M-72, as amended October 20, 1942, places the collection of scrap tin cans under stricter control. Among other things, it rules that a used tin can which was made to take the shape of a flat sheet must be classed as "tinned scrap consisting of tinplace". No authorized person is permitted to collect tin cans whose contents have not been removed.

Shellac Prices Fixed The prices of shellac were fixed by the Office of Price Administration on October 21, 1942 by the issuance of Protective Coating (Shellac) Maximum Price Regulation No. 245. For example, for London TN orange shellac in lots of 100 or more bags, the ceiling is 35.5 cents per pound f.o.b. New York; for regular bone dry bleached shellac in lots of 1,500 pounds or more in barrels, the ceiling is 42.5 cents per pound f.o.b. New York. This order lists the price ceilings on over 50 different grades of shellac.

"Silver Ordinary" Price Fixed On October 29, 1942 the Office of Price Administration issued Order No. 2 under Section 3(c) of the General Maximum Price Regulation, effective October 30, 1942, which fixes the maximum price of "silver ordinary" at 45 cents per troy ounce .999 fine on about 5,000,000 ounces which have been made available by the United States Treasury to industrial users upon the recommendation of the WPB.

Silver Sales Reports Simplified The amount of paper work required of sellers of semi-fabricated articles of newly-mined domestic silver was reduced by Amendment No. 48 to Supplementary Regulation No. 14 under the General Maximum Price Regulation on October 31, 1942. The amendment eliminates lengthy reports with affidavits to support the sales of such domestic silver. The OPA states only a short report must now be filed if affidavits were posted with the Director of the Mint, United States Treasury. Newly mined domestic silver has a maximum price of 71.111 cents per ounce. The Maximum price for all other silver is 45 cents an ounce. Prices on silver articles can only be adjusted to reflect the actual newly mined domestic silver content.

Small Business Aid Proposed Senator James M. Mead of New York and Representative Charles F. Lea of California introduced identical bills (S. 2880 and H.R. 7752) in both houses of Congress on October 29, 1942, which provides an annual appropriation of $10,000,000 for the setting up and operating of a unit within the Department of Commerce whose function it will be "to aid small independent business of the country by the collection and dissemination of knowledge of business management and its application to specific problems and opportunities, that the American system of free enterprise may be strengthened and that individual small business may be continued at a profit to the businessman and the community."

Research Laboratories Aided Through the issuance of Preference Rating Order P-43 as Revised November 5, 1942, and Preference Rating Order P-135 dated November 5, 1942, research laboratories have been given assistance in securing a continued supply of laboratory equipment and reagent chemicals. All laboratories holding a serial number under P-43, may now obtain an AA-2X rating to buy equipment, reagent chemicals and other materials. Order P-135 grants the same rating to laboratories holding a serial number to make reasonably easy the procurement of supplies and equipment for analytical, testing, control, educational and research purposes.

Rhodium Restriction Continued Conservation Order M-95, which prohibits the use of rhodium in the manufacture of jewelry, was to expire on December 31, 1942, but, Amendment No. 2 of Conservation Order M-95 issued on October 26, 1942, provides that the order shall continue in effect until revoked by the WPB Director General for Operations.

Safety Razor Production Curbed General Limitation Order L-72, as amended November 3, 1942, provides that "no manufacturer shall use any copper in the production of safety razors except for plating purposes provided the copper so used does not exceed an average thickness of .0004 inch in the safety razors produced." And no manufacturer is permitted to process, fabricate, work on or assemble safety razors except for the military forces of the United States and for export for lend-lease purposes.

Steel Drum Containers Controlled All new steel drum containers and parts in the hands of manufacturers were placed under complete allocation control on November 2, 1942 by WPB General Preference Order M-255. Authorization applications to deliver or sell steel drum containers must be addressed to the WPB Containers Branch, Washington, D. C.

Tin Deposit in Nevada J. O. Greenan, a Nevada mining engineer, has revealed the discovery of a tin deposit in the northeastern part of Nevada. The importance of this discovery is still uncertain even though the first ore removed showed a high tin content.

Tinplate Restrictions Pyrethrum and retenone must now be packed in some substitute like glass or blackplate and not in tinplate containers according to Amendment No. 4 to Conservation Order M-81 issued on October 20, 1942. The use of tinplate coating on containers for apples, crabapples and applesauce was restricted by this Amendment. Restrictions were also placed on the use of tin cans for other foodstuffs.

Tin Oxides and Anodes Prices The maximum prices for tin oxides and tin anodes bought by the Metals Reserve Company were fixed at "prices in cents per pound dry weight of tin content, properly packed in wood containers f.o.b. Barber, New Jersey" instead of f.o.b. point of shipment, by Amendment No. 1 to Order No. 4 under Maximum Price Regulation No. 204 (Idle or Frozen Materials Sold Under Priorities Regulation No. 13), dated November 11, 1942.

Tin Substitutes Discussed At the recent Washington meetings of three WPB Canning Industry Advisory Committees and at two specialized industry conferences, methods of conserving tin and other critical materials were discussed. Among the topics discussed at these meetings were (1) the possibilities of packing tomato juice in glass containers instead of tin cans, and (2) the use of a lighter tin coating for tin cans.

Tinned and Detinned Scrap Through the issuance of Tinned and Detinned Scrap Supplementary Order M-72a, as amended Ocotber 20, 1942, the WPB aims to recover about 10,000 tons of pure tin from salvaged old tin cans collected by more than 400 municipalities of 25,000 persons or more in 15 northeastern states. This amended order has placed a ban on the sale of tinned scrap and terneplate to steel producers. Tinned scrap may be sold only to dealers and brokers for resale in the same form to shredding plants, detinners, and copper precipitation plants.

SWPD Contract Awards Increase Frank Smith, Deputy Director of the WPB Smaller War Plants Division, revealed that a total of 39 prime contracts, totalling $16,000,000, have been awarded by the Division as of November 13, 1942. Plans are being worked out to increase the spread of contracts among small businessmen.

Terneplate Container Order Since November 30, 1942 the packing of varnish removers, liquid lacquers, lacquer thinners, lacquer stains and shellac in tinplate containers has been prohibited by Amendment No. 5 to Conservation Order M-81 as amended June 27, 1942. This Order also prohibits the use of tinplate and terneplate containers for the packing of edible oils if the quantity is less than five gallons.

Use of Zinc Further Restricted Conservation Order M-11-b, as amended, issued Nov. 26th by the Director General for Operations, further restricts use of zinc for manufacture of a variety of automobile parts, building materials, and industrial materials, *and clarifies the language of the order to make it clear that protective coating and galvanizing is included in the restrictions of the order.*

Process Lines Developed for Electrolytic Tin Plating and Flowing

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The U. S. is a "have not" nation insofar as tin is concerned. Normally, this country consumed a third of the world's total output of that metal while producing virtually none of it.

When the Japanese captured the Malay Peninsula, the Dutch East Indies, Thailand, Indo-China and Burma, they gained control of the source of two-thirds of the world's tin, creating a serious war problem for the U. S. Steps were taken by the government and industry to conserve the nation's tin stockpile. The most important conservation measures applied to its use as tin plate because that consumed three times as much tin as any other single product.

Tin plate made by dipping steel sheets into molten tin ordinarily takes one and one-half pounds of tin for every 100 pounds of steel but a government order restricted this to one and one-quarter pounds. This spurred development of the electrolytic tinning method for it requires only one-half pound of tin for every 100 pounds of strip, one third the amount needed on hot-dip lines. The electrolytic process has other advantages—it is faster, can be handled in form of large coils and the coating is applied uniformly. The following two articles present the highlights of the electrolytic process and a new and interesting development in the flowing of the electrodeposited tin.

TODAY'S tin shortage has accelerated the development of suitable processing lines for the electrolytic deposition of tin on steel. This process, which has been the object of considerable experimental work for the last few years, has now been taken from the laboratory and made a necessary part of modern steel making practice. Indicative of this progress are tinning lines which are capable of turning out a sheet, tinned on both sides, three feet wide, at the rate of 1000 feet per minute.

The several types of tinning lines thus far developed have two basic differences. One is whether the speed through the plating bath is held constant or allowed to decrease when a fresh coil of steel is entered into the line. The other principal difference is whether the plating tanks are vertical or horizontal. In one type of mill the steel moves through the plating tanks at constant speed, and means are provided for accumulating enough slack at the entry end to allow the end of a new strip to be welded on. The other scheme, which in general allows a faster speed of strip, allows the entire line to slow down when necessary to start a new roll. In the line with horizontal plating tanks the two sides of the sheet are tinned separately allowing variation in thickness and even in kind of metal deposited, if necessary. In the vertical tank line the sheet is tinned on both sides as one operation and hence exactly alike. To present a clear picture of the problem involved and the associated electrical requirements the two most dissimilar types of lines will be discussed.

Constant Speed, Vertical Tank Line

Consider first the constant plating speed, vertical tank line, as shown in Figure 3. The steel to be electrically tinned comes to the tinning line in the form of a strip 0.005″ to 0.015″ thick, up to 36″ wide and three miles long, wound into a tight coil. This coil weighs about 30,000 pounds and is about five and a half feet in diameter. It is placed on one of the two uncoilers at the entry end of the line. The end is then squared in the shear, and is threaded through the welder and the first pinch roll. From the pinch roll it is threaded successively through the entry looper, the plating tank, the rinse tank, and the master pull unit. The strip is fed through the delivery looper, the tension device, the second shear, and entered on the reel. The line is now completely threaded and ready for operation.

As a processing line of this type is operated from a variable-voltage system, the line is started by increasing the generator voltage until it overcomes the internal drop of the line motors so that the strip just starts to move. The fields of the plating generators are excited. The plating current and the line speed are simultaneously increased, until the desired operating speed is obtained, by properly manipulating the rheostats of the plating generator. A line of this type usually has a maximum running speed of 500 to 600 feet per minute because it does not seem advisable to have several strands of strip running faster than this through loopers whose top rolls are at times 30 to 35 feet above the bottom rolls.

Tin Thickness Controlled by Current

The plating current is manually adjusted to produce the desired coating weight. In this type of line the anodes of cast tin are supported vertically between the vertical passes of the strip. The negative bus of all plating generators is connected to the contact rolls shown at the top of the plating tank. The positive terminals of the plating generators are connected either to individual anodes or to several anodes in parallel. The plating current can be supplied from either a low-voltage, high-current, direct-current generator or a dry-type rectifier. Both methods are being used on lines now being built.

The thickness of the tin deposited or coating weight is a function of both time and speed. Hence, the plating power required is determined by the speed of the line at which a given coating weight is to be applied. Once these two factors have been decided the total plating power requirements can be determined, but this does not necessarily mean that heavier coatings cannot be

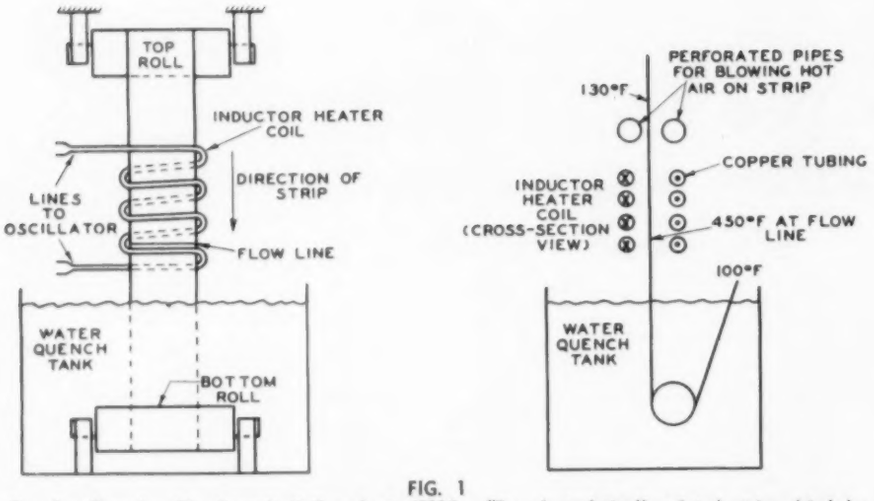

FIG. 1

Fig. 1.—*Granular Tin Deposit Reflowed at 452°F.* The electrolytically plated strip, dried by hot air enters the inductor heater coil at 130°F. Here it is heated by high frequency current to the melting point of tin, 450° F, after traversing about 90 per cent of the coil length. At this temperature the rough tin deposit flows into a smooth surface. The strip then runs through the water quenching tank where the tin is hardened and the temperature reduced to about 100° F.

put on or that the line cannot be run at a higher speed. Heavier coatings can be made at reduced speeds while lighter coatings can be deposited at higher speeds. It is essential only that the proper relationship between the total power and the speed be maintained for the desired coating weight.

Master-Pull Unit Determines Line Speed

The strip passes from the plating tank to the rinse to remove all plating solution that adhered to it. The strip then enters the master-pull unit. This roll is esentially the master unit of the entire ling because the speeds of all the other drives are referred to it. This drive, therefore, fixes the speed at which the strip passes through the line. For this reason it always operates at full-field strength so that its speed is entirely dependent on the applied generator voltage.

From the pulling pinch roll the strip passes through the delivery looper into a tension device. This device operates as a drag generator to insure a tightly wound coil, so that the individual layers will not slip on each other when the coil is handled. Finally the strip is wound into a coil on the mandrel of the reel.

Coils Changed Without Interruption

Another large problem remains for electrical control to solve. When only a few turns remain on the uncoiler the operator accumulates as much strip in the entry looper as possible by speeding up the entry pinch roll slightly. Then when the end of the coil approaches, the entry pinch roll is stopped, the end of the strip sheared off to square it, the end lapped on the new coil (which has been previously placed on the other uncoiler above it) and the two ends welded together. During this operation, which normally takes 30 to 40 seconds, the remainder of the line has been operating at normal speed, using the strip accumulated in the looper. On completing the weld, the entry pinch roll is started by a conventional magnetic controller and again operated from the variable-voltage bus. By a similar procedure the delivery end of the line can be stopped to change reels.

Speed Variation Obtained by Armature Voltage Control

The principal advantages of a line of this type are its simplicity of control, the fact that motors of limited range of field control can be used, and relatively low strip speed requiring only a small amount of driving power. The control is simple because once the line is started the speed of the major part of the line remains constant even though at times either the entry or delivery ends are stopped briefly. Practically all the speed variation is obtained by control of the armature voltage. Therefore, it is possible to use motors provided with only a small amount of field control, which makes for a low-cost installation. Only the uncoilers and reels require any appreciable speed range. This is because of the coil changes in diameter.

Variable-Speed, Horizontal Tank Line

The second basic type of line is shown schematically in Figure 4, and is a high-speed line with horizontal plating tanks and variable-speed plating. This line consists essentially of three distinct units in tandem. These are: first, the plating unit with uncoilers, pinch roll, No. 1 drag roll, and the plating unit; second, the flow or fusion unit with the flow zone, branner, and precision tension unit; third, the shearing unit consisting of a pull unit, loop, flying shear, classifier, and pilers. This line has been designed for operation at 650 feet per minute, with provision for making changes to obtain speeds as high as 1300 feet per minute. Because a shearing line cannot be operated faster than about 700 feet per minute without excessive buckling of the sheets, provision has been made for coiling the finished strip and then shearing it into sheets as a separate operation when the line is operated faster.

Automatic Tension Control Eliminates Slack

Tension is automatically maintained between the pinch roll and the uncoiler to keep the slack out of the strip. With any slack the whipping action would probably break the strip. This same tension regulator also automatically compensates for the change in the diameter of the coil as strip is paid out. The loop is automatically controlled by photo-electric devices that speed up or slow down the entry end of the line as required.

Tension is automatically maintained in the plating unit by having the precision tension unit pull the strip through the tank against the drag produced by the No. 1 drag unit acting as a belt-driven generator. Tension must be accurately maintained to insure a good contact between the strip and the conducting rolls through which the plating current enters the strip; also there must be no chance for the strip to touch the anodes, thereby short circuiting the plating cell and burning the strip.

From the plating tank the strip passes through the reflow unit into the quench tank, from the quench tank through the branner, and into the precision tension unit. In the reflow unit the electrolytically deposited tin is heated just to the temperature where it will flow and produce the mirror-like finish expected of tinplate. The strip is then quenched to harden and preserve this surface. Next, it is oiled and the excess oil is removed in the branning machine. It is important that the tension be accurately controlled through this sequence also.

Strip Is Sheeted and Sorted

The reeling operation for this line and the one previously discussed are the same. The strip passes from the No. 2 drag unit to the pull unit, through the pull unit into a loop, and from this loop into the flying shear. Thence it goes to the classifier where it is automatically sorted, and finally delivered to one of two pilers. To obtain accurate lengths of sheet it is essential that there be no tension in the strip as it enters the shear because tension might cause some slippage of the strip on the feed rolls that pull the strip into the shear. For this reason the strip must always enter the shear from a loop. Just before the strip enters the shear it is usually passed through such devices as a pinhole detector and a flying micrometer. These function to pick out the sheets with pinholes in them and those that are too thick or too thin. A suitable memory device with either the pinhole detector or the flying micrometer, operates a gate, 10 to 15 feet beyond the shear in the classifier, to shunt, the rejects into the off-gauge piler.

Photoelectric Regulators Adjust for Changes in Line Speed

As this particular line uses copper oxide rectifiers to supply the plating current, the control will be discussed on that basis.

Inasmuch as the coating thickness is proportional to the current and speed, an electronic regulator is used that operates from both a current and speed impulse to adjust automatically the speed of the entire line. This regulator is set for the desired coating weight; then, plating current is applied. This regulator adjusts the main generator voltage to operate the entire line at the speed to give this weight. To change the line speed it is necessary only to increase or decrease the total plating current accordingly.

To reflow the tin in the reflowing zone, a photo-electric regulator is used. This regulator scans the strip as it passes and regulates the heating medium accordingly. Such a regulator is possible because tin, fortunately, is a solid at one temperature and just a few degrees hotter becomes molten so that the actual reflowing occurs in a narrow temperature zone. This regulator operates essentially as a position indicator and automatically compensates for any change in line speed.

When the shearing unit is operating separately the photo-electric loop control operates in the field circuit of the uncoiler to maintain the loop, which is standard practice. However, when this unit is in tandem with the other two units this method of operation is obviously impossible. Instead, the photo-electric loop control operates in the field circuit of the main generator, used to operate the entire shearing unit. In this way the entire unit is speeded up or slowed down to maintain the proper loop.

3600 Horsepower Required

This second type of line requires the largest power input, which is natural because of its higher spill. The line uses about 25 d-c motors of from one to 125 hp, and approximately 75 a-c motors ranging from ½ to 60 horsepower. The plating unit requires approximately 60,000 amperes at 12 volts or 720 kw, direct current. A total of approximately 600 kilowatts direct current is required from the generators to supply the variable-voltage power. This means, therefore, that the total power for this line at rated load and speed is about 2700 kilowatts or 3600 horsepower.

Flowing Improves Corrosion Resistance

Because the tinplate produced on one of these electrolytic lines has a gray matte surface it is desired to reflow the tin coating to obtain the smooth, polished surface to which we are accustomed. This flowing is necessary not only to improve the appearance,

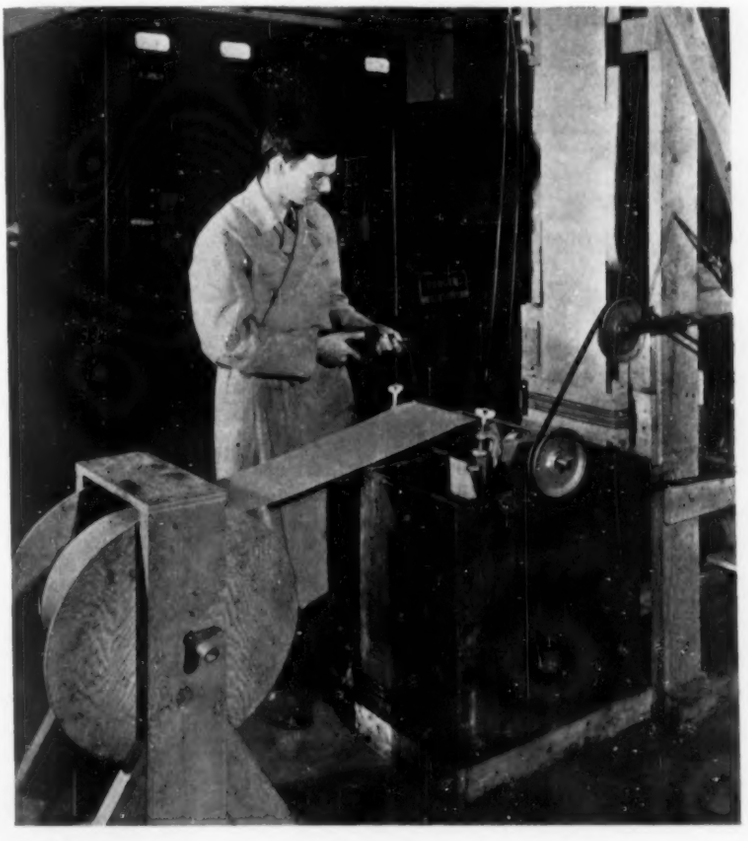

Fig. 2.—*Radio Waves Fuse Tin.*—Radio waves from ten feet of coiled copper tubing on this pilot will quickly put a shiny corrosion-resisting finish on tin plate urgently needed to pack rations for the armed forces. The new process is five times as fast as big gas furnaces or vats of hot oil. The strip emerges bright and shiny from the inductor heater coil where 200,000 cycles a second melted the tin into an evenly-distributed coating. Cooled in a water tank below the coils, the tin is now ready for the can factory.

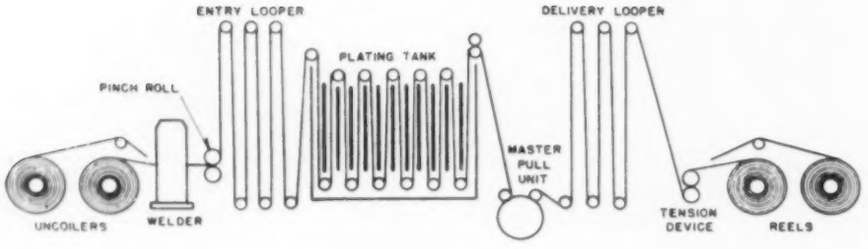

FIG. 3

Fig. 3.—*Schematic Diagram of Constant Plating Speed,* vertical tank line. The steel sheet is wound in a tight coil up to 36 inches wide and three miles long. This strip threaded through the electrolytic tinning tank and on to rewind rolls.

but to reduce the porosity of the coating and improve its corrosion resistance.

Several methods have been proposed for this flowing operation. The most important of these are: passing the tinned strip through a hot oil bath, passing the strip through a radiant tube or some other type of furnace, using the electrical resistivity of the strip itself to heat it conductively, passing it through a high-frequency inductor heater coil, or a combination of these methods.

Hot-Oil Bath & Radiant Furnace Make Flowing Separate Operation

The hot-oil bath can be used successfully on low-speed lines. Because the differential between the melting point of tin (450° F.) and the temperature at which the oil can safely be heated is low the speed is limited. Further, because this reservoir of heat can be generated only at a relatively low rate, and the temperature cannot be quickly altered, the strip must be passed through the bath at constant speed.

The furnace method also is satisfactory for low-speed work, but becomes quite bulky as the speed of the strip is increased. The furnace must be from about one-third to one-half foot long for each foot per minute that the strip travels; a practical limit of 200 to 300 feet per minute is set for the radiant furnace method. Here again, the heat can neither be generated nor dissipated at a high rate, which restricts its use to a constant-speed operation. Neither the hot oil nor the furnace methods lend themselves readily to incorporation in the electrolytic-tinning line itself, but make flowing a separate operation. This, of course, entails additional handling of the strip during processing.

High-Speed Conduction Heating May Cause Marred Surface

Melting the tin by the heating effect of current flowing through the tinplate itself does not have the speed limitations of the hot-oil or furnace method. Neither does it restrict the process to a constant speed inasmuch as the current can be readily controlled as the speed is changed.

With this method, however, there is the problem of getting the power into the strip at high speeds without arcing and burning at the contact rolls where the power is introduced into the strip. Because the strip with the coating heated is in actual contact with the current-collecting rolls, there is a possibility of marring the tin surface. By this method it is necessary to heat a section of the strip while at the same time attempting to quench it.

Induction Heating Permits High Speed Continuous Operation

By the induction method the tinned surface is brought to the melting point of tin by the same methods now extensively employed by industry in electromagnetic heating except that the frequency and power involved are much greater. In fact, the equipment is a broadcasting set of enormous power. Based on a strip speed of 1000 feet per minute an oscillator of 1200 kilowatts output is required for most commercial strip. It is interesting to note that just one of these induction heating units has a radio frequency output of 24 radio broadcasting stations of 50 kw capacity. This equipment requires approximately 2300 kilowatts of power input and covers a floor space of approximately 650 square feet.

In the induction system there is no physical contact between the strip and any stationary or rotating member. Thus, there can be no marking of the strip either by electrical or mechanical action. The heating is done in a very short space even at high speeds, the space required being of the order of 10 to 12 feet at a speed of 1000 feet per minute. No heating is done at the time that the strip is being quenched.

Inasmuch as flowing of tin is a relatively new operation, practical experience may indicate the wisdom of using some combination of these flowing methods. Such a combination might be to use both electric conduction and induction, in which the tin is preheated by current carried through the strip and the final heating to the reflowing temperature accomplished by induced current.

The complete process can now be performed in one line instead of several operations, each requiring additional handling of the steel. The coating applied has been reduced to approximately one-third, by weight, of its former value. This development is, therefore, one of the major advances being made in the steel industry today.

High Frequency Heating Conserves Critical Tin

By G. E. STOLTZ

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HIGH frequency heating at 200,000 cycles per second to melt tin electrolytically deposited on a steel sheet, saves critical tin, speeds production, increases corrosion protection and facilitates the mechanical handling of the plated sheet. Already at work in one steel mill, this latest result of electronic research flows 12 square feet of tin in seven-tenths of a second, which is much faster than was previously practical with gas furnaces or huge vats of hot oil.

This high frequency method of fusing tin makes practical the final step in electrolytic tinning which saves two-thirds of the war-scarce tin. The electrolytic coating of only 30 millionths of an inch on each side of the strip, or less than one-hundredth the diameter of a human hair, cuts 60 millionths of an inch off the coating applied by the old hot-dip process. Additional saving in both tin and steel sheet may be realized by high-frequency heating since no waste is encountered from scoring or from marking the sheet by either electrical or mechanical action. In the induction system it is possible to melt and quench the tin plate between guide rolls (Fig. 1). As the power input to the inductor coil (which determines the amount of heat generated) can be immediately and automatically adjusted to correspond with any change in speed of the strip, the proper temperature to melt the tin is maintained and oxidizing of the strip eliminated.

In answer to the problem of boosting output of tin plate to keep pace with the rapidly-growing requirements of our armed forces, high-frequency heating equipment is being designed to operate at speeds up to 1000 feet per minute while gas furnaces are limited to 150 f.p.m. and hot oil to 200 f.p.m. At present electrolytic plating is operated at a maximum of 500 feet per minute, but in the near future this speed will be doubled and full advantage made of the high speed operation of induction heating.

Only tin plate with high corrosion resistance can be used to pack foods containing acids, such as tomatoes. To provide the steel strip with adequate protection, the tin must be heated to the fusion point so as to flow into a smooth, homogeneous texture. Electrolytically deposited tin forms a granular dull grey surface which is not highly corrosion resistant. With the corrosion dependent on the thinner spots, the overall effectiveness of the tinplate deposited is not high, until it is fused and a uniform thickness obtained by the peaks filling the valleys.

Great care must be used in handling the tinned strip as the tin is a very soft material and is easily scratched. The rehandling problem is avoided with induction heating since sufficient power can be generated in the sheet to heat the strip to the fusion point of tin immediately after it passes from the plating tank. Within 0.7 of a second after the strip enters the coil, the temperature is brought up to 450° F., where the tin melts and starts to flow into a smooth, even surface. Only a few feet of line-travel are required to produce sufficient heat when the strip is passing through the inductor coil at 1000 feet per minute. This flowing operation becomes an integral part of the tinning line, instead of a separate operation requiring an additional handling of the strip. (Fig. 4).

With induction heating the power input may be adjusted rapidly to accomodate changes in the speed of the line, such as during periods of acceleration or deceleration when two coils are welded end to end. A speed change simply means a corresponding change in the power input to the heater coil.

It was first believed that the flowing operation was necessary only to provide greater corrosion resistance. In addition, it was found that this smooth coating is essential for the sheet-by-sheet suction cup feed on the high-speed can making machines. The rough surface on the coating lets air creep in under the cups and causes sheets to stick together when lifted.

The frequency at which the required current can be induced in the strip without using abnormally high voltages depends upon the thickness of the sheet. Since tinplate usually is of the order of 0.008" to 0.011", a frequency of approximately 200,000 cycles per second is most practical for this thickness of sheet.

The inductor heater coil is rectangular in form, wound as close to the strip as mechanically possible. It acts as the primary of a transformer while the strip itself constitutes a single turn secondary. The induced current flows across the strip paralleling the turns of the inductor heater coil. The heat generated in the strip is due to the resistance of the strip and the current flowing through it.

The power is supplied by vacuum tube oscillators, which are essentially the same as the transmitter of a radio station. Sixty cycle alternating current is rectified to direct current and fed to the oscillator tubes where it is converted to 200,000 cycles per second and sent out through the inductor heater coil. One plant is installing tin flowing oscillator units with 72 times the power of the most powerful radio broadcasting station in the United States.

In general the practical high frequency limit for rotating machinery is of the order of 15,000 cycles per second—for applications requiring higher frequencies, it is customary to use vacuum tube oscillators.

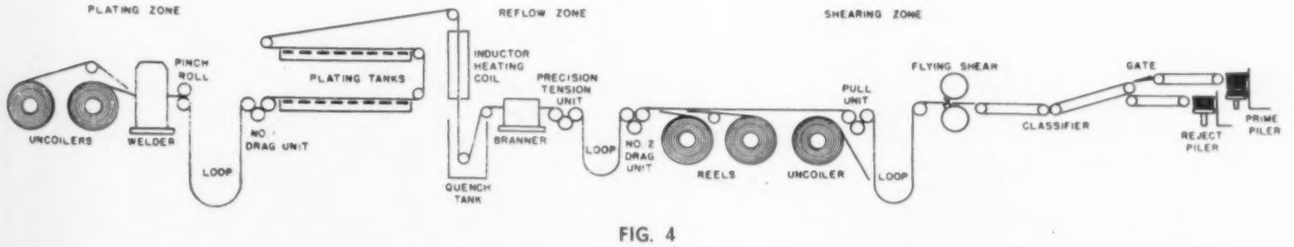

FIG. 4

Fig. 4.—*Schematic Diagram of Variable Speed, Horizontal Tank Line.* In this line the electrolytic tinning, fusing and sheeting is a continous, complete operation. However, an optional delivery, rewinding instead of sheeting for the fused tin plate can be employed.

The Trend of Electroplating Development†

By S. WERNICK, Ph.D., M.Sc.

This is a forecast of post-war development as hazarded by a British authority on electrodeposition.

We are not as pessimistic about the future of the job shops (out platers) as is Dr. Wernick. Job shops have a tenacity which is unique in the business world. As a matter of fact, considering the enormous amount of inferior plating, due to shortages, done in the last few months before ornamental plating was prohibited in this country, the job plater should be in a particularly fortunate position after the war since there will be plenty of plated articles requiring re-finishing.—Ed.

THERE cannot be any doubt that there will be a general desire after the war to return to decorative plating. Indeed, there is a good possibility that with the shortage of articles of luxury and semi-luxury types which war conditions are bringing about to an increasing extent, there will be something in the nature of a boom period when articles of this type will be wanted in large quantity and wanted rapidly. However, I do not anticipate that the moment the war is over there will be a general removal of all restrictions as they affect plating today. It is more likely that the demand by the public for decorative plating will not be satisfied for some considerable period. The probability is that it will take time before various materials in short supply at the moment are again plentiful.

An additional possible factor, too, is that there will not be an immediate wholesale changeover from war-time to peace-time metal finishing, since one may well imagine that production of armaments will not be halted immediately and may, in fact, continue although on a reduced scale, for some considerable time after the war. It is unlikely that we shall make the mistake that we did after the last war insofar as armament reduction is concerned.

However, one may, I think, deduce that there will be an appreciable amount of decorative work available for the metal finisher.

With regard to the quality of this work, there are two possibilities—the first is that an overwhelming demand for metal finishes coupled with shortness in the supply of materials for producing these metal finishes may result in a natural temptation on the part of the plater to reduce the quality of his finish. If this should occur, I think it would be regrettable in the highest degree. It would, in fact, be doubly unfortunate because one of the few benefits which the industry has derived as a result of the war has undoubtedly been that it has been forced to produce metal finishes rigorously to specification.

Many of us will remember that there was a great deal of discussion during the ten or fifteen years prior to the war as to the desirability of electroplating being produced on a specification basis. There were, undoubtedly, many difficulties in the way arising very largely through competition on the part of the small minority of electroplaters who were out to obtain quick returns and had no pride whatever in their product or in the industry. The advent of specifications which were issued by Government departments immediately cut across the whole of this controversy and forced the industry to supply electrodeposits and finishes, the quality of which had to exceed an irreducible minimum.

A Specification-minded Industry

I believe that already the electroplating industry is specification-conscious and that the benefits of adhering to a specification have now become manifest in many quarters where previously there was considerable doubt not only of the practicability of adhering to a specification but also the desirability of doing so. I trust that if we do not gain anything else as a result of the war, we shall at least not lose this specification - mindedness which now imbues the industry in such a healthy fashion.

Already a considerable amount of work has been done in the way of standardization of materials used by the electroplater. It is particularly gratifying to observe that the bulk of this work not only originated through the aegis of this Society, but was also carried out by the latter's own Standards Committee which was set up some years ago and has done such excellent work in close co-operation with the British Standards Institution. As a result, there are now in existence several issued specifications carrying the authority of the British Standards Institution covering important chemicals and anodes employed in plating baths. These have been accepted by the trade and at the cessation of hostilities, I believe the time will be ripe for an immediate continuation of this good work which should result, in due course, in the drawing up of specifications to cover electroplating processes and metal finishes generally.

Heavy Deposit Development

A further likely development should result from the experience which is being gained at present on the production of heavy nickel and chromium deposits for building-up purposes. In many cases this kind of work has been taken up at relatively short notice in order to cope with the requirements of the Services, and after the inevitable teething troubles the quality of work (which is of a far more exacting nature than decorative nickel deposition) has had to, and does, reach a very high minimum standard. The value of this process, which was already realized to some degree in certain industries prior to the war—for example, the automobile and shipbuilding industries—is likely to be further appreciated by many other industries, particularly those with an engineering bias, and as a result heavy nickel and

† *Condensation of the chairman's address to the Midlands Centre of the Electrodepositors' Technical Society presented at the James Watt Memorial Institute, Birmingham, England, on September 1st, 1942.*

chromium deposition are likely to be wanted on an increasing scale as time goes on.

In particular, the use of chromium deposits for wear resistance, apart from decorative plating and building-up applications, is likely to see a considerable impetus in the post-war period. The possibilities for chromium as a deposit are really very wide indeed and despite the large quantity of chromium which was deposited in pre-war days purely for decorative purposes, it is not outside the bounds of possibility that the volume of work awaiting the application of chromium for wear-resisting purposes will equal and perhaps in time exceed the peak figure so far achieved in the decorative field.

The application of heavy nickel and abrasion resistant chromium deposits on a really big scale will in turn mean something in the nature of a revolution in electrodeposition technique and plant requirements of the industry. One can readily envisage this when one realizes that the time factor is likely to increase many times since batches of work will not take minutes to produce but hours, days and even weeks; while at the same time the important requirements of complete adhesion of the deposit to the base metal and absence of any laminations in the deposit due to interruption of current, are a *sine qua non* of these processes.

Factory Metal Finishing Versus Out-Plating

A further field of interesting speculation is the post-war outcome of the growth of metal finishing departments inside factories. Undoubtedly, many factories which in pre-war times sent out their metal finishing work, including enamelling and plating, will be in the position to do this work within their own organization. What is the likely outcome so far as the job-plater is concerned? It would seem that it will become increasingly difficult for the small out-plater to give the necessary service on the scale which firms having their own plating department may require; while, furthermore, it is likely that his resources may not equal those of the larger plating firms. There is, therefore, a distinct possibility that the small out-plater may be squeezed out of existence unless he seeks the remedy which other industries have successfully adopted, namely, that of amalgamation with similar establishments to form a self-contained unit with full resources capable of satisfying any requirements inside the trade.

Whether this will be a desirable development is perhaps a moot point. It will perhaps be regrettable to see the small job-plater who has produced work of consistently good quality in the past, have to sink his individuality and his craftsmanship by pooling his resources, but this is a natural trend under modern mass production conditions. On the other hand, perhaps it will not be a very deplorable thing to see the exit of the type of plater who has made a specialty of producing cheap work of poor quality and has never been an ornament of the industry.

Improvement Inside the Shop

In general, it is likely that there will be a general improvement in types of plating plant and operating conditions inside the plating shop, and this will follow the steady improvement which has gone on in recent years in the installation of plating plants.

Probably the worst feature of the older type of plant was the haphazard way in which the original layout was planned, and this was then markedly worsened by later additions to the plant at irregular intervals as the department grew in size. It is possible for a plant layout to be efficient enough for initial requirements but prove to be an unsuitable "core" for future developments. When planning a plant it is usually well worth while to consider what plant alterations or extensions will be required to cope with not less than a 100 per cent increase on the production load. An uninterrupted work flow, economy of operators' movements, as well as compactness and ultimate costs are the more important factors which require careful consideration.

All types of plating plant are employed in this country, ranging from the most modern fully-automatic unit, perhaps 100 or more feet in length, to the simple type of plant which was in use in the early part of the century. The plant location is perhaps better now than it was during the latter period, but factory managers have been slow to appreciate that a good location for a plating plant and, where possible, a special building to house it, are important factors in the production of good quality plating, while at the same time effecting appreciable savings. The practice of relegating the plating department to the worst lighted, least accessible and badly drained part of the factory premises is one which dies hard. It is a tradition arising from the period when the plating shop was looked upon by otherwise broad-minded managements as a curious place where mysterious chemical operations were performed by plating foremen who were quasi-alchemists assisted by platers only less alchemically trained. In this department there were not precise machines, lathes, or presses, but vats containing colored liquids which seemed to percolate everywhere, acids and potash tanks, dangerous cyanides, etc., so that obviously the most correct housing for such contraptions (hardly a plant!) was that part of the factory remotest from the engineering shop—usually the dingiest, darkest and dirtiest basement that could be found. The management usually would give the department a wide berth, visiting it as little as possible and giving the foreman in charge full powers of control in the way of ordering supplies, engaging staff, etc. This arrangement was one which, truth to tell, suited the type of plater whose actual knowledge was sketchy, but who could produce plating of a passable quality by rule of thumb methods learned in the trade.

Need for Technical Direction

This is not meant to belittle the undoubted value of the better type of foreman who, really skilled in the arts of plating, was at his best when improvising workable methods for overcoming difficulties despite the poor facilities at his disposal. It is a pity that in the past foremen of this calibre have not been more articulate in demanding better conditions in the shop, but whether through lack of sound technical direction or otherwise, it is evident from the appearance of the average small plating installation that only a minority of platers have taken the real measure of opportunities that exist for improving working conditions. It is a melancholy fact that many plating shops look unclean and uninviting. Who has not encountered the shop in which the vats are encrusted with salts, the floors are covered with liquor of mud-like consistency, and sawdust

seems to permeate the plant everywhere?

It has been remarked that at least one benefit will result from enemy action—that much slum property which should have been pulled down long ago now awaits rebuilding, and that an unprecedented opportunity will arise after the war to build along sane, modern lines. A similar opportunity might be used to plan reconstruction in the plating industry.

Value of Education

It seems probable, too, that the kind of individual who is likely to be attracted to the plating industry will be of a progressively better type as time goes on. Better conditions inside the shops will undoubtedly attract men who would normally find such conditions irksome. A very important factor here is the desirability, if not in fact the absolute necessity, for educational facilities for all who enter the plating industry. A knowledge of elementary chemistry and electricity must be considered an essential part of the training of those who wish to rise in the industry to executive posts. Such education and training can be acquired either prior to entering a shop or simultaneously with the acquisition of practical plating experience.

The work which lies ahead undoubtedly will need men of reasonably good education as operatives and so far as executives are concerned, they will need to be skilled both in the theory and the practice of modern electroplating methods.

Competitive Industries

Finally, a question worth examination is the incidence of competition from other industries and how far this will affect the future of the electroplating industry. To a greater or less extent, the finishes which the electroplating industry can produce are competitive with those produced by our friends in the paint industry. Up to now, however, there has been sufficient scope for both types of finishes, metallic as well as organic, and it is likely that this state of affairs will continue. From time to time electrodeposited finishes have achieved a degree of notoriety through failures in service, but almost invariably this has been shown to be due not to the electroplating processes but to the manner in which they have been carried out. The tendency in late years has been to improve the quality of electrodeposits and undoubtedly maintenance of good quality will be the sheet-anchor of the industry. This links up once again with the question of working to specifications laid down by experts who have determined the minimum requirements and who emphasize the importance of specification-plating in the future.

A recent source of anxiety to the electroplating industry has been the advent and very vigorous growth of the plastic industry. Undoubtedly, "Bakelite" has proved to be a very important material in the mass production of common articles, and to some degree has superseded similar articles constructed of metal which had received an electroplated finish. To some extent the metal finishing industry is certainly bound to lose a certain amount of work through the adoption of "Bakelite" and similar synthetic materials. However, on the other hand, "Bakelite" has its limitations and I for one cannot envisage a world in which the aesthetic appearance of silver plating or the appearance of chromium plating will be abandoned and replaced by the pastel shades of semi-bright synthetic materials of the "Bakelite" type.

Indeed, a recent development has indicated clearly the resourcefulness of the electrodeposition industry. I refer to the production of electrodeposits on "Bakelite" itself as a base material.

This itself is a tribute to metal as the final surface finish in most fields. The plating of "Bakelite" products has been very considerably practiced in Germany where, for some years before the war started, shortage of metal resulted in synthetic condensation products of the "Bakelite" type being used as substitutes. These, in turn, were then plated to make them look as much like the original metal article as possible. There are distinct possibilities in the process, since the combination of cheap mass production of "Bakelite" plus an attractive metallic surface finish may confer big economic advantages. The welding of "Bakelite" and electrodeposition in this manner should result in important advantages to both industries and would be a happy solution of the competitive difficulty.

With all these post-war possibilities, I imagine there will be much to exercise our thoughts and activities when the world becomes a saner and safer place to live in. Events may prove that I have painted the future in somewhat optimistic colors, for no doubt if a period of depression lies ahead for trade in general, our industry cannot hope to escape it entirely. We are fortunate, however, in that there is a peculiar degree of flexibility in the commercial applications of electrodeposited finishes, so that one way or another there is much of interest and even fascination which lies ahead.

Of one thing I am convinced: if the watchword of the industry is the continued development and improvement of its processes and products, its progress will be assured whatever vicissitudes may lie ahead.

E. A. HARTY

Correction

In the November issue of METAL FINISHING, there appeared an article entitled "Rectifiers for Electroplating". This article was written by E. A. Harty, Tungar & Metallic Rectifier Engineering Department, General Electric Company, Lynn, Mass. and the by-line should have been E. A. Harty instead of R. W. Williams.

Chromium Chemicals Unrestricted

An amendment to Order M-18-b issued by the War Production Board dated September 30th, places the purchase or use of chromium chemicals for all purposes on an unrestricted basis, regardless of the industries in which they are used or the end products made. The filing of form PD-54 continues to be required, as in the past, except in the case of chromic acid for which these forms are not necessary.

SUBMERGED COMBUSTION TAKES ITS PLACE IN THE WAR INDUSTRIES†

BY Walter George See

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TWELVE years ago experiments were started on submerged burners for pickle room use. It was realized that the burners must be simple in design, fully automatic as to ignition and control of temperature and, above all, rugged enough to withstand the treatment and corrosive conditions of the pickle room. As a result, all experimental work was done in a pickle room under actual working conditions. The results obtained from the first experimental burner were most encouraging, and from that point on, it was purely a matter of improvement and simplification.

When placed on the market five years ago, the burner had a simple and reliable ignition system. The metal used in the burner could be guaranteed for one year in sulphuric or hydrochloric acid and had an expected service life of two years. Even then, the entire burner did not need to be replaced as the design permitted sectional replacement of that portion which was attacked most quickly, namely, the burner plate and bottom end of the burner tubes. This meant rapid and economical repair without the loss of production.

Single Button Controls Unit

Simply stated, this submerged combustion system consists of a control assembly designed so that the operator or watchman has only to press a starting button to put the entire unit in operation. When the unit is shut down, the solution in the tank being heated seeks its own level, completely filling the combustion chamber and part of the burner manifold.

When the starting button is pushed, an air compressor is started up. The compressor delivers the products of combustion at a pressure sufficient to overcome the head of liquid in the tank. As the compressed air is purging the burner of solution, the control system begins to operate. Automatically a hot wire igniter is heated to incandescence by the passage of a high amperage-low voltage current, and after a predetermined time, a flow of pilot gas is admitted to the burner where it is ignited. The main gas flow is then permitted to pass into the burner where it is ignited by the pilot flame. The air-gas ratio is automatically controlled to give maximum combustion efficiency. The burner might be classed as a nozzle mixing type with no possibility of back firing.

The burner plate is located beneath the solution level to insure the cooling of the combustion chamber by the surrounding liquid. The tubular combustion chamber conducts the heat and products of combustion down to and across the bottom of the tub where they are vented and distributed to give the proper agitation.

Following the ignition of the main gas flame, the burner controls lock themselves into a running position until the desired solution temperature is reached. The thermostat then acts to shut off the gas flow and thus stop the heat in-put. However, the control mechanism is so designed that the air continues to flow through the system to maintain a fixed rate of agitation regardless of solution temperature.

When the thermostat registers a demand for heat, the controls recycle to automatically establish and ignite the gas flows. With the heat in-put so controlled, the solution temperatures can be maintained as close as one-half of one degree if necessary, but for pickling, the control range is usually set at 3 to 5° F.

Burners are supplied in either single or double units. A single unit consists of a compressor, burner, and the necessary apparatus for ignition and control. Rated capacity of the single units range from 250,000 to 1,300,000 btu per hour. (Editor's note: 250,000 btu is equivalent to approximately 500 cubic feet of manufactured gas or 250 cubic feet of natural gas).

In a double unit, two burners are connected to one compressor, the controls remaining essentially the same except that provision is made for additional ignition current, and the gas and air controls are arranged so that these flows can be adjusted for each burner.

Submerged Combustion for Pickling

Athough submerged combustion may be used to advantage in many types of solution heating, and is arousing much interest in the evaporation field for concentrating corrosive solutions, at present its greatest strides have been made in the heating and agitating of pickle liquors. It has long been known that the rate of scale removal from steel is greatly increased by agitation and aeration. Agitation may be accomplished by moving the work while in the solution, or better, by moving the solution about the work.

With submerged burners, the products of combustion are exhausted directly into the solution. This creates a terrific agitation and the pickling solution is agitated and moved about the vat at a rate which would be extremely difficult to achieve mechanically. As a result, the average pickling time on various grades of steel are

†*Reprinted in part from the October issue of "Wire and Wire Products", this paper was originally delivered before the Wire Association Convention, Cleveland, Ohio, in October*, 1942.

reduced 40 to 70% of former practice if the operating temperature is held the same as it was with steam. The agitation also serves to keep the temperature uniform throughout almost any size tank.

In general, the trend for pickling temperatures has been downward in recent years. The lower temperatures have much to offer where they can be used and still meet production demands. Pickling temperatures of 185 to 195° F. are expensive from many standpoints. Surface heat loss at 190° is almost twice that at 160°. More heat is required to bring the steel up to this higher temperature and as more steam is used, there is more dilution from condensation. Besides these very concrete cost factors, there is a much faster deterioration of handling equipment and building structures.

The reason why many plants use temperatures of 185 to 195° is that it is the only way they know to obtain the tonnage necessary to keep their machines supplied. However, the amount of tonnage obtained from a still tank heated with steam to 190° can be equalled or bettered by submerged combustion at 160°.

For example, there is the case of a wire and rod pickling department in which it was necessary to crowd five yokes of coils into a vat designed to handle four yokes and to maintain a solution temperature of 190° in order to keep the machines supplied with pickled material. With the installation of submerged combustion, the temperature was dropped to 165° and only four yokes were pickled at a time. Not only did submerged combustion overcome this 25° drop in temperature and 20% load loss, but the new output ran 5 to 10% over what this tub formerly produced when it was steam heated. The superintendent of this plant has stated that he could produce even more tonnage if his handling equipment were adequate to service the tank as fast as it should be.

Another user who first tried submerged combustion for bar pickling, and later equipped his wire pickling set-up, reports that he has reduced his operating temperature in both departments from 185° with steam to 155° under his present set-up and has still obtained a 20% increase in spite of the temperature drop. In this case when further production is needed, he can obtain it without expansion by merely boosting his temperature to 165 or 170° as long as necessary to carry the load and then drop back down into the more economical heating range of 155°. The benefits in reduced heating costs, maintenance, and operating conditions from these lower temperatures are obvious.

However, let us assume that a plant is already operating in the range of 155 to 170° and wishes to continue at the same temperature. Let me quote one wire man who, after using submerged combustion in one tank for six months, ordered a second unit for his other tank. "We have had very good results with the first unit. The savings and increased efficiency in our cleaning line have been the deciding factors in our decision to install the second unit. The agitation loosens the scale more thoroughly and quickly and consequently requires less washing. Due to the great amount of agitation we are also able to clean more rods on each pin. The pickling time on basic rods has been reduced from approximately one hour to 20 to 30 minutes." Although this time figure may appear high, conditions and requirements vary from plant to plant and these figures are of value only as a comparison of what was done with steam as contrasted with the results achieved by direct firing.

Another company in this category pickling wire rods showed an increase in pounds per man hour of 209% over steam the first year the burners were in operation.

As a rule, operating men are hesitant to release figures on their new equipment until they are sure that those figures represent a fair picture. This is understandable, and although complete figures are not yet available from some of the newer installations, indications are that similar reductions in pickling time are being achieved where the handling equipment is adequate and the bakers do not constitute a bottleneck.

Economical Regardless of Gas Costs

Users of submerged combustion have found that they could switch from steam to gas-fired submerged burners even when the gas costs in their particular district were relatively high. At present there are several installations running on propane. It is perfectly logical that the most economical place to generate heat is at the point of consumption, and that is just what submerged combustion does. It generates the heat right in the pickling solution. Further, it generates only the heat required by that solution at any given time. No heat is generated and allowed to die in long runs of steam pipe, or to heat the lines which carry it to the point of consumption. Nor is a direct fired vat dependent on a boiler house whose efficiency falls off rapidly at anything less than full boiler load. On the other hand, the combustion efficiency of submerged combustion is very high. At 140° it runs about 96%, at 160° about 88%, and at 170° about 84%. Many plants use their boilers in the summer time for the sole purpose of supplying steam to the pickle room. In such plants, submerged combustion affords the opportunity to eliminate this extra charge and allow the complete shut down of the boiler house during those months when steam is not needed for heating the plant.

Steam costs and boiler efficiency probably vary more widely from plant to plant than any other single item of costs. However, as the following figures are comparative only, they serve the purpose of showing the economies to be gained by the use of direct firing burners.

One user who pickles bar and rods formerly showed a steam cost of 45 cents per ton of steel pickled. Using gas which cost 75 cents per thousand cubic feet or 75 cents per million btu's, his heating cost with submerged combustion is only 13.5 cents per ton. This is a direct savings of 31.5 cents per ton of steel pickled. Incidentally, this plant used steam only for pickling in the summer time and was able to shut down the boiler house all summer long.

Another user doing pickling similar to that above pays 50 cents per million btu's for his gas and has reduced his heating cost from 17.5 cents per ton with steam to 5.5 cents with submerged combustion, which shows a saving of 12 cents per ton.

Still another user who pays 56.5 cents per million btu's reports a heating cost of 22.7 cents per hour for a tank holding four yokes of coils and having a surface area of 105 sq. ft. This vat contains 3000 gallons of solution at 165°. Although no former steam costs were given for comparison, the approximate heating cost with the burners is 6.1 cents per ton.

Probably the most outstanding saving in heating cost has been made in a

mill pickling racked sheet. This plant pays 20 cents per million btu for natural gas. Their steam cost per ton was 35 cents as compared with a heating cost of 1.5 cents per ton after installing submerged combustion, thus realizing a saving of 33.5 cents per ton. Incidentally, the production increase in this particular application was limited to about 87% because of crane service.

Acid Consumption Reduced

Along with the production increase and lowered solution heating costs, there is a very definite saving in acid consumption. When live steam is used for solution heating, condensation results. Naturally, the amount of this condensation depends on steam pressure at the pickle vat, its btu value there, and how dry it is. In any case, there is always some condensation and consequent dilution of the acid. In some plants this dilution may be so great that the solution level is raised to the point where some of the pickle liquor must be drained off to maintain the proper working level. A certain amount of acid is thus lost, and the weakened solution must be built up by the addition of new acid.

When submerged burners are used, however, dilution is completely eliminated. In fact, the direct firing evaporates water and tends to concentrate the solution so that a small amount of water must be added to maintain the working level of the bath. In addition to the amount of acid thus saved, the terrific agitation causes a scrubbing action on the chemically loosened scale. This creates a further saving in acid which may total 25 to 50% of the acid added after the original bath is made up. In some plants this percentage may be bettered considerably.

Sometimes it is hard to realize just how much money can be saved by careful control and consumption of acid. For example, one company had two leaky wooden bar tanks which they replaced with two new brick tanks. Their boiler set-up was inefficient, steam was replaced by submerged combustion in both the bar and wire tanks and immersion burners were used to heat the lime tanks. At the end of the first year of operation under the new set-up the figures were compared with those of a previous year in which the tonnage pickled was almost identical. The comparison showed that while $22,418 was spent for acid in 1937, only $10,145 was spent in 1939. Although it is hard to estimate just what part of this saving of $12,273 was due to the use of submerged combustion and what part was due to elimination of tank leakage, it does show that big money can be saved on acid alone.

Another plant which uses submerged combustion in both bar and wire pickling reports a former acid consumption of 23.1 pounds per ton with steam as compared to 18.4 pounds per ton with direct firing burners. This savings of 4.7 pounds, or a little over 20% resulted strictly from the use of submerged combustion, as no other change in practice was made.

Another user reports a saving of 140 pounds of acid per day from a small two yoke tank in which he pickles basic rods. He also adds that he is able to run his iron content 2% higher with submerged combustion before he has to dump his vat. In view of the acid problem in his locality, this is a very definite advantage to this user. In fact, these savings in acid and the ability to run the vat a little higher in iron content will become more important as time goes on and munitions makers consume more acid. The most important factor in this respect, however, is the tightening of restrictions on spent acid disposal as more states pass stream pollution bills and sanitary districts and sewage disposal plants are set up. In most cases this means that the spent acid must be hauled away, the acid neutralized or machinery set up for reclaiming it. In any case, the lower acid consumption effected by submerged combustion means less acid per ton of production which must be hauled away or otherwise processed. Further, due to the evaporative effect of the burners, the solution level can be allowed to drop before tub dumping time so that less spent liquor will have to be handled.

Savings in Replacements

There are very few departments in any plant as hard on equipment as the average pickle room. Let me stress the word "average." Although management has come to realize the importance of this department in such matters as costs, die life, and the quality of the ultimate finish, few plants have done anything about making it a clean dry place for either men or equipment to operate efficiently. By and large, there is not too much intelligence found among pickle room labor and as a result, equipment has to stand up under poor handling and little care as well as under severe corrosive conditions.

Quite often the question is asked "How does submerged combustion stand up under actual operating conditions?" By way of answer to this question, let us take a look at several case histories of the older installations in plants other than that in which these burners were developed.

Case Study 1. Installation date: December 15, 1937. This unit consisted of two burners of 750,000 btu each, placed in a tank holding approximately 6000 gallons. By August of 1940, two years and eight months later, the bottoms of the burners were corroded to the point where replacements were necessary. About a year after this installation was made, a new burner was designed which was easier to ignite, had less critical flow settings, and would handle up to 1,800,000 btu per hour. Rather than repair the two smaller burners, a deal was made to replace them with one burner of the new design.

During the two years and eight months that the two old burners were in service, replacements ordered consisted of a spare set of blades for the air compressor to be held in stock, two junction boxes, six igniters, two valves, a new set of brass petcocks, a spare seat and diaphragm for the gas regulator, and finally just before the changeover, six more igniters.

During the two years since August 1940, three seats for the gas regulator and a spare burner plate have been ordered, making a total replacement cost of $211.50 for four years, plus the cost of switching burners. During the guarantee period a short developed across the main terminal of the ignition control and it was replaced.

Case Study 2. Installation date: March 17, 1941. This unit consists of a single burner and in its one year and eight months of service has four igniters chalked up against it for a total of $24.00

Case Study 3. Installation date: October 5, 1941. In the one year of service for this single unit, the only replacement necessary has been the repair of the temperature control bulb

which was broken through carelessness. Charge: $10.00.

Other case studies show pretty much the same story in connection with replacements. Some mills will run heavier than others simply because of differences in operating conditions, and depending on whether the mechanical crew operates as maintenance men or a repair gang. Probably the most often replaced item is the igniter. Normal expectancy is two or three months for this item which can be changed in about five to ten minutes. Many cases are recorded where the igniter has lasted eight months without being changed. Where conditions are favorable, a four to five month average is not unusual.

As is the case with all machinery, there is a certain amount of general maintenance to be done. Here, again, the amount will vary with working conditions within the vat, and the procedure of the individual shop. Periodically, the gas and air lines should be broken at the hose connections and water flushed through the burner to remove any ferrous salts and foreign matter which may have accumulated in the lines or behind the burner plate. Extreme cases may require this action every two or three weeks depending on the time down between shifts, the condition of the solution, and the gas used. In most cases, however, every two months is often enough, and we have one installation which was in operation eight months before it had to be cleaned out. As a matter of fact, quite a few users never touch these lines until such time as they begin to have trouble getting the full gas flow.

The life and maintenance of the combustion chamber is strictly a variable. With reasonable care it will last for years and rarely require any maintenance. On the other hand, a careless pickler may flatten it out or bend it a week after it is put in. The chamber is usually placed so as to be as far out of the way as possible, but sometimes accidents will happen in spite of anything which can be done to prevent them.

Special Chamber for Solutions of High Iron Content

Another possible source of trouble for the combustion chamber may come from the iron content of the pickling solution. Where the acid is dumped before the iron content reaches about 0.65 pounds of iron per gallon, which is equivalent to approximately 28 Baume or 8% Fe., lead can be used for the combustion chamber. However, should the iron content be run above this point when lead is used, the ferrous salts will plate out on the lead, building up a coating perhaps of 1/32" thick. This coating insulates the lead sufficienty to cause it to burn out at a point where the salts are the heaviest. When the user wishes to run his iron content above 0.65 pounds of iron per gallon, a graphite chamber is used as this material is unaffected by the iron content.

In general, when the pickler is properly informed, and a little common sense is used, very little trouble is experienced with the combustion chamber or any other part of the equipment. In fact, one user reports that the maintenance on his submerged combustion units run below the average for the other machinery in his plant.

That these burners very quickly take their place among the dependable production machinery in a plant is clearly shown by the reply given to a service man who called to check up on a unit which had been in operation over two years. When asked how the unit had been doing, the superintendent replied, "Why, hell's fire, if it weren't for our production figures, we wouldn't even know it was there."

Communications on Silver Plating Steel

"To the Editor of METAL FINISHING:

The article by P. J. Lo Presti in the Oct. issue is on a subject about which there has been considerable controversy. It was hoped that his extensive work would prove the value of the use of a phosphate coating on steel to improve the adherence of a silver deposit.

The paper on 'The Adherence of Thick Silver Plate on Steel' by H. Lance Crosby and L. I. Gilbertson presented at the meeting of the Electrochemical Society, Detroit, Michigan, about the same time as Lo Presti's paper was published, is in direct contrast as to the method of handling the subject and the data presented.

In the 'Phosphate Method' a 25% phosphoric acid is used. In the test a phosphate coating is assumed to have been produced on the steel by the phosphoric acid dip. In the legend for the micrographs the words, 'phosphate dip' is used instead of what actually was used—phosphoric acid dip.

It is generally understood that to produce a phosphate coating on steel it requires at least, if not more than, an hour. Yet Lo Presti obtained one in a dip, which no doubt was done in seconds.

Some pieces of cold rolled steel were immersed for 10 seconds in a 10% hydrochloric acid and a 25% phosphoric acid. The steel dipped into the phosphoric acid was etched more than the steel dipped into the hydrochloric acid. It appears that this etching of the surface was mistaken for phosphate coating. These pieces were immersed in a copper sulphate solution. Both of the steel pieces received a bright coating of copper. If there had been a phosphate coating on the 'phosphate' one there would have been but a slight, if any, deposit of copper.

As the salts formed by the phosphoric acid on steel are soluble in water or in the alkali silver strike it is difficult to accept the statement that a phosphate coating was produced.

There are no data offered that indicate that a phosphate coating improves the adhesion of silver to steel. This effort can be considered a failure.

George B. Hogaboom
Electroplating Consultant
Conservation Division, WPB."

Mr. Lo Presti's reply:

"Dear Dr. Meyer:

In reply to the criticism received from Mr. Hogaboom, I have mailed to you under separate cover samples of steel which were successfully silver plated by the method I described as 'Phosphate Coating'.

Mr. Hogaboom is not correct in the statements he makes, as you can testify by the excellent adhesion of the silver plated samples after being bent at a 180° angle and then straightened out again. In regard to the paper of H. Lance Crosby and L. I. Gilbertson entitled 'The Adherence of Thick Silver Plate on Steel', they present an excellent theory on the function of a silver strike, but in the 'Phosphate Method' no separate strike was used other than the regular silver plating solution.

As to the question of whether the phosphoric acid dip imparts a phosphate coating on the steel base, this can be quite a controversy. In testing the coating produced, in only a 30 second dip a trace of phosphorous was noticed with the ammonium molybdate method.

From the experiments carried out, my theory for the excellent adhesion obtained by the 'Phosphate Method' is due to a combination of the ferrous oxide and phosphate film and also from the deep etching caused by the phosphoric acid. The oxides and phosphates produced prevent the deposition of silver by immersion. The film is then reduced by the hydrogen produced and adherent silver is deposited immediately. (It could be dissolved by the cyanide.—Ed.).

In regard as to whether my effort can be considered a failure, this contention is quite doubtful, when by this method, a silver deposit is produced that has good adhesion.

Thank you very much, Dr. Meyer, for your consideration in allowing me to comment on Mr. Hogaboom's letter.

Very truly yours,
Philip J. Lo Presti."

PLATING AND FINISHING
POLISHING — BUFFING
CLEANING — PICKLING
HOT DIP FINISHES

SHOP PROBLEMS

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. The questions this month are answered by G. B. Hogaboom, Jr., Nathaniel Hall and Dr. Walter R. Meyer. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Brass Plating Upon Stainless Steel

Passaic, N. J.

"Gentlemen:

In brass plating steel for rubber adhesion we have encountered a problem that is new to us and I would appreciate any advice which will enable us to overcome our difficulty.

One of our customers has furnished stainless steel inserts to which rubber must be bonded. Our manufacturing department brass plated these metals in the regular way. After the rubber had been vulcanized, it was found that the bond between the rubber and the brass was satisfactory, but no bond existed between the brass and the steel. We have two items which result in this condition. One insert is designated on the customer's blueprint as "monel" metal and the other as stainless steel, type No. 303.

Is a special treatment of these steels necessary before the brass plating is applied? If so, I wish to thank you in advance for any information or references you may care to supply.

Very truly yours,
U. S. R. Co."

Answer: The electroplating upon stainless steel or "monel" metal requires a preliminary treatment to reduce the normal passive film present. The most effective treatment is that done in a nickel chloride solution acidified with hydrochloric acid. One common procedure employs the following solution:

Nickel chloride ..... 32 oz./gal.
Hydrochloric acid, 22 Be .... 16 fl. oz./ gal.

The work is made the cathode using six volts which will apply from 50-70 amperes per square foot. Block carbon anodes are used. Operate at room temperature from 30 seconds to two minutes.

The International Nickel Company has found that a short reverse treatment in the solution described tends to produce a slight etch which gives a better bond. They, therefore, make the work the anode for about 10 seconds and then reverse current making the work the cathode for about 2 minutes. Using this procedure,* a film of nickel is applied. The work is then rinsed and transferred to the plating solution.—W.R.M.

*Process patented by Int. Nickel Co.

Silver Matte Finish

Los Angeles, Calif.

"Gentlemen:

We have been applying a silver matte finish to dials which is made up of silver precipitate powder and sodium chloride and we have two questions regarding it.

The first is, is it possible to salvage any silver from this compound after it is once wet?

The second is, is there a lacquer or paint that we can apply which will give a similar finish?

Yours very truly,
K-R D Corp."

Answer: It is possible to salvage the silver from the powder by treating the mud with a sodium cyanide solution containing about 4 oz./gal. of sodium cyanide. This will dissolve out the sodium chloride and the small amount of silver chloride which has been formed and will leave the silver powder which can then be washed out thoroughly with warm water. However, it will probably be cheaper in the long run to accumulate the mud and send it to a refiner.

There are a number of lacquers on the market which will give a finish similar to the silver graining and it is suggested that lacquer companies, such as those advertising in METAL FINISHING, be consulted.

Fire Gilding on Sterling Silver

New York, N. Y.

"Gentlemen:

Can you advise me how to obtain a formula for doing fire gilding on sterling silver pieces?

Yours very truly,
H. D. R. Co."

Answer: Fire gilding is applied by rubbing an amalgam of mercury and gold over the article and heating in an oven to a temperature high enough to boil off the mercury.

The amalgam is prepared by weighing out the amount of gold desired for the particular piece and amalgamating it. It is then brushed on the article with a camels' hair brush and heated in the oven to a temperature above 675° F. which is the boiling point of mercury. This leaves the gold film permanently bonded to the sterling silver.

This method of gilding is not recommended and has fallen into disuse due to the fact that mercury fumes are very highly poisonous and unless proper ventilation means are at hand, the procedure is particularly troublesome. In addition, due to restrictions on the use of mercury, it will probably not be permitted for this application.

It is suggested that the gold be applied by electrodeposition, as is customary, using any of the formulae given in the "1942 Plating and Finishing Guidebook."—N.H.

Copper "Creeping" in Carburizing

We are at a loss to explain the following phenomenon experienced in pack carburizing, and if any reader has some knowledge of the solution of this problem, his sending of it to METAL FINISHING will be greatly appreciated.

The Problem: Cylinders of approximately 1" in diameter are copper plated over all (no thickness mentioned), and after plating, a portion of the plate on the side of the cylinder is removed in a centerless grinder. The parts are then pack pulverized and an extra heavy case is applied requiring a long exposure to the carburizing temperature.

According to the inquirer, the copper plate creeps toward the middle of the pin from the ends during the carburizing process and this "creeping" or diffusion of copper results in obtaining a somewhat softer structure of the order of 10 points Rockwell C near the point affected by the creep. It is stated that the position of the cylinder during carburizing seems to have no effect upon the creeping difficulty.

Zirconium Plating

In the October issue of METAL FINISHING inquiry was made as to whether there is a method of depositing coherent coatings of zirconium.

Mr. Gustaf Soderberg, technical director of The Udylite Corporation, Detroit, Mich., has sent us the following information on this subject.

"I have in my files only one reference to electric zirconium coatings, namely, German patent No. 625,217 published February 6, 1936. Beginning with line 96, page 4, it reads as follows: 'In order to deposit conducting small particles, for example, coating the electrode of an electric discharge tube with zirconium, powdered zirconium may be milled or triturated with acetone and suspended in this manner. It is found that a zirconium coating which adheres well to the cathode is obtained in one minute at an electrode distance of 1 cm., using 200 volts across the electrodes.'"

New Copper Solution Fails to Plate

New Britain, Conn.

"Gentlemen:

I have always experienced difficulty trying to get any plate out of the following bath when it is first made up. This has happened every time we have made up a new solution—about 5 times.

Copper cyanide	3	oz./gal.
Sodium cyanide	4.5	"
Sodium carbonate	2	"

Plating is done in a horizontal-type barrel, temp. about 135° F., amperage 300-400, with 25 square feet of work.

At one time when we made up a new solution we put in more sodium carbonate and it finally plated but it took a long time. This last time with a new bath, we increased the sodium carbonate from 2 oz./gal. to 5 oz./gal. adding 1 oz./gal. at a time. After the 5 oz. were added, it took about 8 hours to plate a thickness of 0.00075" on steel parts for carburizing. Gradually, it takes less and less time with each load until our normal time of 1½ hours is reached. We then have no trouble until an excess of carbonate is formed.

I would like to know why we are having this trouble every time we make up a new solution using this formula since it is published everywhere as a workable formula including the "1942 Plating and Finishing Guidebook."

I should also like to know whether copper plating for carburizing can be done in barrels from the Rochelle type copper bath without too much trouble.

Yours truly,
S. P."

Answer: The reason for the long time required to deposit 0.00075" of copper on 25 sq. ft. of work with 300-400 amperes can be said, in general, to be due to poor cathode efficiency.

The poor efficiency can be due to the solution depositing excessive hydrogen. This can be caused by one of two things—either the composition of the solution or the type of metal being plated. For example, some metals such as iron castings have a surface of such a nature (covered with carbon particles) that the hydrogen overvoltage is low; in other words, hydrogen deposits in preference to copper.

If the solution has excessive free cyanide, the cathode efficiency will be low; that is, excessive hydrogen will be deposited. We suggest you investigate this angle first as it is the simplest and easiest to check. The free cyanide can be reduced by adding copper cyanide to the solution.

It will be found, however, that if the free cyanide is brought too low, the anodes will coat over (polarize) and the current will drop off even though the original voltage is maintained. This action can be overcome by adding Rochelle salts to the solution, up to 6 oz./gal.

Other possible causes of the trouble are impurities in the solution (zinc, for example, will produce a serious loss in efficiency) and not having the solution adjusted to the best pH for your work. A Rochelle copper solution operates best about pH 12.6. The deposit from such a solution is satisfactory for work to be selective carburized.

Other things to check are excessive current going to barrel contacts or stray current going into the tank. If the tank is plain steel, place wire glass plates behind the anodes. This will cut off the path taken by the current from the anodes to the tank and over to the work load.

Who Does Lead and/or Iron Plating?

One of the war departments would like to have a list of the companies in the United States which have facilities for either lead plating, iron plating or both.

Will any company having such facilities write to METAL FINISHING, stating the tank capacities and total amperage available for these plating operations.

Patents

Corrosion Prevention of Iron

U. S. Pat. 2,294,571. T. P. Remy, September 1, 1942. A rust preventing composition consisting of weak acid for attacking oxides with a minimal attack on the metal body containing titanium tetrachloride in solution.

Example:

Phosphoric acid	1,400 cc.
Water	1,500 "
Ethyl alcohol	750 "
Butyl alcohol	190 "
Hydrogen peroxide	75 "
Titanium tetrachloride	40 "

Apply to surface and allow to stand until rust is removed. While still wet, wash off with water and dry.

Pickling Steel

U. S. Pat. 2,295,204. T. Dockray, September 8, 1942. A method of pickling cold rolled steel strip which comprises immersion in a solution which contains substantially 5% sulfuric acid and substantially 4% of ferric sulfate, followed by a sulfuric acid pickle.

Corrosion Prevention of Iron & Steel

U. S. Pat. 2,295,545. W. J. Clifford and H. H. Adams (England), assignors to Parker Rust Proof Co., September 15, 1942. A process for improving the resistance of ferrous metals to corrosion, which comprises treating with a phosphate coating solution in which the coating action is accelerated by the presence of a minor amount of an organic accelerating compound containing a non-ionic nitro group, such as nitrobenzene, picric acid and nitrophenol in concentration of 0.04 to 0.2%.

Abrasive Cleaning

U. S. Pat. 2,301,508. H. T. Blount, assignor to Mills-Alloys, Inc., Nov. 10, 1942. A centrifugal type of abrasive blasting apparatus having an abrasive throwing wheel of novel design.

Corrosion Prevention of Iron, Aluminum and Their Alloys

U. S. Pat. 2,296,884. J. S. Thompson, assignor to Parker Rust Proof Co., Sept. 29, 1942. A process which consists in treating the metal surface with a solution containing as its chief coating chemicals a compound of hexavalent chromium, a compound comprising an acid radical, and an oxidizing agent other than the hexavalent chromium, at least part of one of said ingredients being introduced in acid form, and continuing the treatment until a visible coating is produced on the surface of the metal after which an organic coating is applied.

Example for steel: Immerse for 5 minutes in a boiling 200 cc. solution to which was added 4 g. potassium chromate, 10 cc. of hydrofluosilicic acid and 2 g. of manganese nitrate. An excellent black adherent coating is obtained with this solution, it is claimed.

Example for aluminum: Immerse for 5 minutes in a boiling 200 cc. solution to which was added ½ g. chromic acid, 5 g. manganese fluosilicate and 2 g. sodium nitrate.

Plating on Aluminum

U. S. Pat. 2,297,241. L. Perner (Germany); vested in Alien Property Custodian, Sept. 29, 1942. An immersion process for the production of a firmly adherent coating of a pure, heavy metal, which is nobler than aluminum and which forms a water-soluble silicon-fluoride or boron-fluoride on objects of aluminum or its alloys, comprising immersion in an aqueous solution of a metal silicofluoride or borofluoride until a coating of a thickness of the order of about 0.1 mm. has been produced. A colloid may be added to the solution in order to modify the coating.

Example: Almost saturated solution of cadmium silicofluoride is diluted with 4 to 5 volumes of water. Gelatine, gelatoses, albumoses, dextrine or sulfite lye is added in the amount of 2 to 5 parts per thousand of solution. The articles are immersed for 5 to 10 minutes at room temperature.

Example: An almost saturated solution of zinc borofluoride is diluted with 4 to 5 volumes of water. Additions of a heavy metal fluoride, say of the metal nickel, iron, copper or tin in the proportion of about 2 per 1,000 and of a colloid in the proportion of about 5 per thousand of the total liquid, follow. The solution is used at about 30 to 40° C.

Electrodeposited Iron

U. S. Pat. 2,296,757. J. L. Young, assignor, by mesne assignments, to Plastic Metals, Inc., Sept. 22, 1942. An electrolytically deposited sheet of iron capable of maintaining its fine-grained electrolytic structure when heated to a temperature exceeding the upper critical, in which the crystalline grains of the deposit are enveloped in a slag of iron oxide and silica. The deposit is applied to a stripping cathode using the usual iron plating practice and a solution containing silica in suitable form.

Phosphate Coatings

U. S. Pat. 2,293,779. R. R. Tanner, assignor to Parker Rust Proof Co., August 25, 1942. A process which comprises applying electrodeposited metallic nickel to a sheet of steel, electrodepositing metallic zinc over the nickel coating, heating sufficiently to produce some alloying of the nickel and zinc and thereafter chemically forming a phosphate coating on the zinc. The phosphate coating may then be treated with chromic acid.

For alloying the nickel and zinc, a temperature of 675° F. for 5.5 hours is sufficient. After cooling, the phosphate may be applied by immersing in the following:

Solution 1:	
Zinc metal	0.75 parts
Iron	5.5 "
Phosphoric acid, 75%	33.3 "
Water, to make	100 "
Solution 2:	
Anhydrous zinc nitrate	25 "
Zinc dihydrogen phosphate	16 "
Nitric acid, 42°	4 "
Water, to make	100 "

To 100 gallons of water are added 25 lb. of Solution No. 1 and 35 lb. of Solution No. 2. The articles are immersed for at least 5 sec. at 175° F., then rinsed in water and given a final rinse in a solution containing 2 oz./gal. of chromic acid for 10 seconds at 175° F. Articles treated in this manner are claimed to have good corrosion resistance and provide improved paint adherence.

Bright Nickel

U. S. Pat. 2,294,311. R. Lind, W. J. Harshaw and K. E. Long assignors to The Harshaw Chemical Co., August 25, 1942. Addition agents for the production of bright and ductile nickel deposits, one selected from the group consisting of amino poly aryl amine compounds and mixtures of such substances in which at least one amino group is connected to an aryl group and being present in the solution in amounts of the order of 2 to 100 mg./l. and the other being selected from the group consisting of naphthalene sulfonates, the single ring aryl sulfonamides and the single ring aryl sulfimides and mixtures thereof soluble in the bath to the extent of at least 0.5 g./l. and present in solution in the bath to the extent of at least 0.2 g./l., said second type of addition agent having no poly aryl amine nucleus.

Example:	
Nickel sulfate	240 g./l.
Nickel chloride	37.5 "
Boric acid	37.5 "
Sodium lauryl sulfate	0.12 "
2, 4, 4'—triaminodiphenylamine	0.01 "
Sulfonated naphthalene	4.0 "
pH	3.3

Bulk Handling Machine

U. S. Pat. 2,299,965. J. V. Davis, assignor to The Udylite Corp., Oct. 27, 1942. A material handling device for articles in bulk comprising a plurality of tiltable containers which discharge from one into the next by gravity.

Nickel Anode

U. S. Pat. 2,297,766. R. O. Hull, assignor to E. I. duPont de Nemours & Co., Oct. 6, 1942. Non-sludging anodes made from cathode nickel and requiring no deskinning, produced by heating the nickel to about 800° C. and then immediately quenching to a temperature below its critical range by immersing it completely in a bath containing about 96% by weight of sulfuric acid or in a bath containing about 10% by volume of 20° Baume muriatic acid and 90% by volume of concentrated sulfuric acid containing about 96% by weight sulfuric acid.

Corrosion Prevention of Metals

U. S. Pat. 2,296,070. J. S. Thompson & E. W. Goodspeed, assignors to Parker Rust Proof Co., Sept. 15, 1942. In the art of rustproofing and priming metallic surfaces, the steps which comprise first obtaining a paint coat upon the surfaces and then applying an aqueous solution containing one of the group consisting of oxalic, chromic or phosphoric acids and oxalates, chromates and phosphates, and thereafter applying any of the usual finish coats.

Example for magnesium:

Sodium chromate	100 g./l.

(Sodium dichromate or a suspension of ferric chromate may be used in the same amount instead of sodium chromate.)

Example for steel:

Zinc dihydrogen phosphate	2 lb.
Nitric acid	0.3 "
Sodium nitrate	0.3 "
Copper carbonate	0.01 "
Water	2.3 "

Use as is or dilute 10 times. Air dry and bake 1 hour at 275° F. Then finish with a lacquer coating.

Brazing Flux

U. S. Pat. 2,296,442. O. Horowitz, assignor to Albert I. Elias, Sept. 22, 1942. A brazing flux comprising an alkali borate, an alkali acid fluoride, halogenides of cadmium and copper and halogenides of alkali metals.

Example:

	Percentage by weight
Boric acid	10
Borax	10
Potassium acid fluoride	1.5
Sodium chloride	6.5
Potassium chloride	33.5
Lithium chloride	1.0
Cerous chloride	5.5
Cadmium chloride	8.0
Cuprous chloride	24

This flux is claimed to entirely eliminate the evolution of noxious fumes and can be used for both ferrous and non-ferrous metals, such as aluminum.

Effect of Impurities

Platers are familiar with the effects of small amounts of impurities on their solutions but few realize that minute amounts in the copper of their bus-bar and racks also have important effects. Before purchasing metal of unknown ancestry, it should be considered that only 0.2% of silicon will reduce the electrical conductivity of copper by 50%.

Removing Hydrogen Embrittlement

U. S. Pat. 2,299,639. J. R. McElhaney, assignor to Carnegie-Illinois Steel Corp., Oct. 20, 1942. The method of removing hydrogen embrittlement from ferrous bodies which includes the steps of successively introducing and removing heat from such bodies a plurality of times so as repeatedly to vary the mean mass temperature thereof, while causing a heat transfer sufficient to vary the mean mass temperature of said body through a range of at least 100° F. below the bluing temperature of the body.

Coloring Magnesium

U. S. Pat. 2,295,842. J. D. Hanawalt & C. E. Nelson, assignors to The Dow Chemical Co., Sept. 15, 1942. A method of producing thick, strongly adherent, corrosion-resistant dyed coatings on magnesium and its alloys, having a corrosion rate of not substantially more than 0.2 mg. per square centimeter per day, by subjection to the action of an aqueous solution at a temperature between 85 and 120° C. said solution containing a soluble salt selected from the group consisting of chlorides, bromides and iodides of the metals located above aluminum in the electromotive series of metals and a dye soluble therein and not discharged by an alkali, whereby a colored coating is produced on said article. *Example*:

Sodium chloride	0.1%
Temperature	100° C.
Time	10 hr.

The articles are then rinsed and dyed in a solution containing by weight 0.1-0.5% of a dye such as Safranine, Gentian Violet, Janus Green, Alizarin Cyannine, etc., by immersion for ½ hr. or more at 85-100° C.

Coloring Magnesium

U. S. Pat. 2,295,843. J. D. Hanawalt & C. E. Nelson, assignors to The Dow Chemical Co., Sept. 15, 1942. The method of coating and dyeing a relatively pure magnesium article having a corrosion rate of substantially not more than 0.2 mg. per square centimeter per day, the steps which comprise subjecting said article to the action of a liquid consisting entirely of water at a temperature between about 85 and 100° C. at atmospheric pressure whereby a coating is produced on said article, and thereafter dyeing the coated article by immersing it in an aqueous solution of a dye not discharged by an alkali.

Why Salts Are Added to Solutions to Improve Conductivity

A current density of 10 amp./sq. ft requires a potential of 2 volts when the anode and cathode are one foot apart in a nickel solution. If all dissolved matter were to be removed, we would find that for the same current density about 250,000 volts would be necessary.

The resistance of conductivity water, as this specially purified water is known, is so great that one inch of it has a resistance equal to that of a copper wire of the same cross sectional area and 632,000,000 miles in length.

However, the addition of less than a tenth of a thousandth of an ounce to a gallon of common salt will increase the conductivity almost 300 times.

The Effect of Copper on Hot-Dip Zinc Coatings

(*Concluded from page* 640)

the product either in tests in the plant, or after leaving the plant. The small copper content in the zinc coating may, therefore, be assumed to have at least produced no visible harmful effects, and may have actually been beneficial in so far as corrosion resistance was concerned.

This seems to completely cover all of the material available on the subject of importance. As stated, absolutely no definite facts have been found on the subject anywhere, so that this discussion is submitted for the purpose of stimulating some careful experiments on the actual facts in so far as copper additions in very small amounts to zinc coatings is concerned. As a summary and final statement it would appear that the very best product that can be produced is a galvanized product with a copper-bearing steel base metal, a copper bearing zinc coating, a weight of zinc coating that is the heaviest consistent with the purpose for which the galvanized product is to be used, and finally the highest skill in galvanizing technique in applying the zinc coating.

Research experiments conducted by the American Society for Testing Materials on zinc coatings with copper, and on base metals without copper, and with copper, should furnish an excellent field for future investigations to improve the qualities of corrosion resistance of zinc coatings. The technical literature indicates that small additions to the zinc will perhaps be as valuable in adding to corrosion resistance as small additions of copper to steel. It certainly appears to be the next logical direction for research investigations to improve the quality and corrosion resistance of hot-dipped zinc coatings.

Bibliography of Copper in Zinc Coatings

1. "The Corrosion of Copper-Steel Fence Wire," by Oliver W. Storey, Report N-716, 1925. The C. F. Burgess Laboratories, Madison, Wisconsin.

2. "Research on the Corrosion Resistance of Copper Steel," by D. M. Buck, Jour. Ind. and Eng. Chem. (American Chemical Society), March 1916, Volume 8, page 209.

3. (a) "Facts Simply and Briefly Told Concerning Keystone Copper Steel."

(b) "The Testimony of a Decade."

(c) "Copper Steels Resist Corrosion. An Established Fact. A Summary of the Conclusions of the Scientists."

(d) "The Influence of Very Low Percentages of Copper in Resistance of Copper Steel."

(e) "Research on the Corrosion Resistance of Copper Steel."

(f) "A Review of the Developments of Copper Steel."

(g) "Observations Upon the Atmospheric Corrosion of Commercial Sheet Iron, Particularly in Regard to the Influence of Copper and Mill Scale."

These are Bulletins by The American Sheet and Tin Plate Company, Pittsburgh, Pa.

4. "Making, Shaping, and Treating of Steel," 5th Edition, by J. M. Camp and C. B. Francis, Rewritten by C. B. Francis, p. 420. Table 65—Spiegel.

5. A series of 11 articles which were published in the *American Metal Market* under the title of "The Destructive Action of Molten Zinc at and above Zincing (Galvanizing) Temperatures Upon Metals and Alloys," by Wallace G. Imhoff. No. 1, Oct. 16, 1928 to No. 11, Oct. 21, 1930.

6. A series of 9 articles which were published in *Metal Cleaning and Finishing*, by Wallace G. Imhoff. Part 1—February, 1935 to Part 9—March, 1936.

7. U. S. G. S. Bull. 770—"The Data of Geochemistry." 1924, p. 688.

8. "Handbook of Metallurgy," by Dr. Carl Schnabel, p. 4.

9. "The Effect of Impurities on the Oxidation and Swelling of Zinc-Aluminum Alloys." Research Bulletin, New Jersey Zinc Co., 160 Front Street, New York, N. Y. 1922.

10. "Some Properties and Applications of Rolled Zinc Strip and Drawn Zinc Rod," by C. H. Mathewson, C. H. Trewin, and W. B. Finkeldey. Bull. No. 153, Sept. 1919. American Institute of Mining and Metallurgical Engineers

11. "The Destructive Action of Molten Zinc, at and above Zincing (Galvanizing) Temperatures, Upon Metals and Alloys," by Wallace G. Imhoff. *American Metal Market*, July 22, 1930. No. 8.

12. "Protective Metallic Coatings," by Henry S. Rawdon. A. C. S. Monograph Series No. 40. Reinhold Publishing Co., 330 West 42nd Street, New York City.

13. "Studies on the Constitution of Binary Zinc-Base Alloys", by W. M. Peirce. N. Y. Meeting A.I.M.E., Feb. 1922.

14. "Rolled Zinc." Research Bulletin. The New Jersey Zinc Co., 160 Front Street, New York City, p. 46.

15. "Galvanizing," by Heinz Bablik. Engineers Book Shop, 168 East 46th Street, New York, N. Y., p. 310.

16. "Zinc and Its Corrosion Resistance," American Zinc Institute, New York, N. Y.

17. "Protective Coatings for Metals," by R. M. Burns, and A. E. Schuh. Reinhold Publishing Co., 330 West 42nd Street, New York, N. Y., p. 101.

18. "A Practical Trial of Roofing Sheets of Copper Steels and Other Materials," by Sir Robert Hadfield. *Steel*, May 24, 1937, p. 70.

The gold bars owned by the United States Government, and which are in storage, are about the size of a common brick. They are 6¾ x 3½ x 1¾ inches, and each contains approximately 400 Troy ounces of gold.

Charles H. Proctor Dies

Charles H. Proctor, founder and former president of the American Electroplaters' Society, passed away on December 3rd after a long illness. He was 77 years old.

Mr. Proctor was a pioneer in the finishing field and remained one of its leaders until his death. Born in Birmingham, England, in 1866, he entered industrial work at the age of 12. In 1881, he came to the United States and worked as foreman plater for various manufacturing companies. In 1912 he joined the Roessler and Hasslacher Chemical Company as electroplating expert and remained through their absorption by the Du Pont Company on May 1st, 1930. He retired in 1933.

In 1909, Mr. Proctor founded the AES from an idea suggested to him by the "Shop Problems" department in *Metal Industry*, now *Metal Finishing*, of which he was an associate editor for many years. In founding this group, it was his intention to gather together all manufacturing platers and manufacturers and sellers of plating supplies in order that they might discuss their problems on a mutually advantageous educational basis.

In memory of his wife who died several years ago, in 1937 Mr. Proctor established the Herminie Dorothea Proctor Memorial Award of $100.00 for the best paper read at the AES convention each year.

Surviving are a daughter, Mrs. Ruby Proctor Preston, and two sons, Edgar and Harry Proctor.

NEW EQUIPMENT AND SUPPLIES

NEW PROCESSES, MATERIALS AND EQUIPMENT FOR THE METAL INDUSTRY

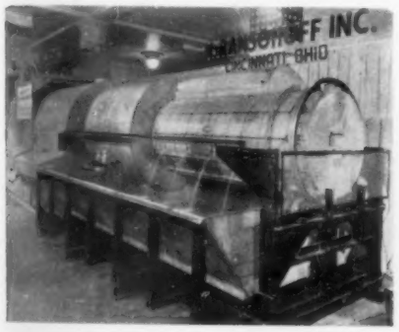
Continuous Parkerizer

N. Ransohoff, Inc., Cincinnati, Ohio, makers of equipment for the surface treatment of metals, exhibited the continuous Parkerizer illustrated at the National Metals Exposition held in Cleveland in October.

The machine, a complete Parkerizing unit, was in operation at the Exposition and was demonstrated by experts from the plant.

This machine eliminates manual labor in putting work through Parkerizing, rinsing, chromic acid rinsing, blowoff, oil dipping and drying. The drum, patented by N. Ransohoff, Inc., is built to hold a level of liquid within approximately three inches of the center which insures complete submersion of the work and permits continuous circulation of the Parkerizing solution without agitation between the drum and the heating tank.

This Parkerizer can be arranged for steam or gas heating. Full details of this machine as well as of their complete line of cleaning machinery may be obtained by writing the Ransohoff Company.



Continuous Parkerizer.

Anhydrous Sodium Metasilicate

The manufacture of anhydrous sodium metasilicate at its Chester, Pa., and Anderson, Ind., plants has been announced by the Philadelphia Quartz Company, Philadelphia. This product is called "Metso Anhydrous," latest member of their line of "Metso" cleaners. It is a technical grade of anhydrous sodium metasilicate, Na_2SiO_3, without water of crystallization.

White and free-flowing, the anhydrous metasilicate is specially sized to reduce dustiness and to permit ready solubility. Of primary interest to fabricators of cleaning compounds for special purposes is its compatibility with soap, wetting agents, and other alkalis, such as caustic soda and phosphates of soda.

Commercial quantities are now being packed in wax lined barrels and fibre drums.

"Roto" Finishing Processes

Crown Rheostat & Supply Co., 1910 Maypole Avenue, Chicago, Ill., have announced equipment for complete roto finishing of metal parts. By the use of this equipment such operations as burring, grinding, honing, polishing and buffing are claimed to be done readily on a large variety of products and different types of base metals.

One machine used and illustrated herewith is the wet roto machine which contains two water-tight compartments and doors. Three distinct operations—grinding, honing and coloring—are used either singly or in combination to produce the desired finish. The grinder operation may be considered equivalent to polishing and is done to remove spinning, drawing and various die marks as well as for de-burring. The honing operation is to further smoothen and brighten the work and the final coloring operation is to produce a brilliant lustre. The machine for wet roto finishing must be located near good sewer drainage, of course.

The dry finishing machine, also illustrated, consists of two steel reinforced hard wood cylinders equipped with a motor having a magnetic brake for stopping the cylinders in any desired position. Each cylinder has two compartments, each with a separate door so that four different batches of work can be run at the same time thus avoiding separating of parts when finished. This equipment is recommended for de-burring as well as for producing a brilliant finish on small parts.

To complete the necessary equipment, the company also offers a centrifugal dryer which is stated to replace sawdust and compressed air drying of small parts. The dryer has a heavy base with welded construction to obviate possible loosening of bolts and screws due to vibration. When the drying problem is difficult, a heating unit can be installed to deliver warm air at the rate of 450 cubic feet per minute by means of a blower.

An eight-page illustrated booklet describing the various roto finishing machines and giving specifications on the same is available from the company.

Burring Compound

E. Reed Burns Manufacturing Corporation, 40 Withers Street, Brooklyn, N. Y., are the manufacturers of a burring compound designed for use with their polishing wheels and brushes.

The compound is designed to cut off burrs and sharp edges quickly. It is used especially in chamfering gear teeth and generally in aircraft parts or machine tool production.

Either a tampico bristle brush, preferably oil treated, or the conventional type hard stitched wheel may be used with this material. The brush method is suggested for work which is irregular in shape or which has spots which are awkward to reach. The wheel method is excellent for flat work and large areas. For such work as threaded parts, a special grade of extra fine grit with a tacky binder for use on wire brushes is recommended.

The binder in the burring compound is emulsifiable and will wash easily either by the degreaser method or in regular cleaning solutions.

Professional Directory

Platers Technical Service Co.
Electroplating and Chemical Engineers
Complete services, including solution analyses, process development and deposit tests.
S. C. Taormina ..... Tech. Director
Dr. C. B. F. Young ..... Tech Advisor
Dr. G. Amorosi ..... Engr. Advisor
(Professional Engineer)
59 E. 4th St., N. Y. C. **ORchard 4-1778**

G. B. HOGABOOM JR. & CO.
Consulting Chemical Engineers
SALT SPRAY TESTING—CERTIFIED TO MEET ARMY AND NAVY SPECIFICATIONS. Testing of deposits-thickness, composition, porosity. Solution analyses, plant design, process development.
44 East Kinney St. **Newark, N. J.**

JOSEPH B. KUSHNER, Ch.E.
Metal Finishing Consultant
War plating plants designed and streamlined for increased production.
LA 4-9794 **233 W. 26th St.**
New York City

Miccro Supreme STOP-OFF LACQUERS
For Masking Parts To Be Hard Chromium Plated

Two Miccro Supreme Stop-Off Lacquers—HR-302 (Red) and HB-401 (Black)—have proved by every test to be the most effective materials ever used for masking parts for hard chromium plating. They offer all of these characteristics:

- Exceptional adhesive qualities but can be removed easily after plating. Conform perfectly to all irregular surfaces.
- Rapid air-drying qualities, reducing time between coating and preparation for plating.
- Can be trimmed cleanly and sharply, providing extremely accurate plating work. Adhesion prevents creeping of solution under any portion of protected surface.
- Can be quickly and easily applied either by brushing or spraying.
- As the material is absolutely neutral and not contaminated by acid or any other destructive substance, there is no possibility of etching in precision, lapped or super-finished machine parts.
- Provide greater dielectric strength.
- When used in heavy deposits, there is no breakdown or electrolytic action.
- Resist not only plating solutions but also cleaning agents used prior to plating.
- Have no toxic properties. Can be used without ventilating systems, etc.
- Also suited for coating permanent, hard plating racks.

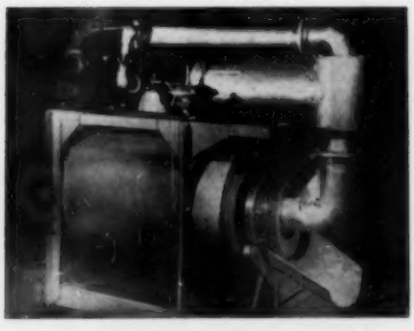
WRITE FOR FULL DETAILS

Developed and Manufactured by Experienced Platers

MICHIGAN CHROME & CHEMICAL CO.
6348 EAST JEFFERSON • DETROIT, MICHIGAN

Quenching and Drying Mechanism

The Salem Engineering Company, Salem, Ohio, have announced the development of a new mechanism for drying and quenching to be used in connection with their annealing furnaces.



Quencher and Dryer.

Materials may be charged into the Salix Dryer (as this machine is called) by means of the individual feeder equipment, or the dryer may be used in connection with a continuous line of other equipment.

Materials are conveyed through the dryer by means of an internal spiral screw which deposits them at the opposite end from which they are received. The materials are tumbled as they are dried. The drying is accomplished by hot air blown into the interior of the perforated drying drum; hence, the hot air comes in direct contact with the parts as they are passing through.

The dryer is complete with automatic temperature control, variable speed drive, etc. This drying mechanism may be designed and built for a wide variety of products where temperature requirements approximate 400° F. Patent is applied for.

New Pot-Type Salt Bath Furnace

A new, electric,pot-type furnace, known as the Falcon High Temperature Salt Bath Furnace, has been developed by H. O. Swoboda, Inc., 164 Thirteenth St., New Brighton, Pa., for cyanide hardening of tool steel products. Designed for production work and general shop heat treating, this versatile furnace is not only suitable for cyanide hardening but also for regular thermal hardening as well. Its operating temperature is 1650° F. In addition, its high-precision controls permit the operation of the furnace at low temperatures for tempering.

This salt bath furnace is provided with throttling-type automatic controls, including a potentiometer-type control pyrometer with an input regulator. A contactor is also provided for carrying the furnace load.

The furnace casing is of steel with an alloy pot which is suspended from the casing into the furnace chamber by means of a heavy cast intermediate ring. The pot dimensions are 16" I.D. x 18" deep. The heating elements are supported in open face grooves in high grade refractory heater plates. Brick and block type heat insulation is used throughout. The hinged, swinging-type cover is easy to operate.

Terminals are brought out through the casing into an enclosed terminal box located on the back of the housing so that there are no exposed electrical connections at any point on the furnace. Capacity of the unit is 30 k.w., 220 volts, single phase current. It can also be connected for use on 3-phase current.

Abrasive Belt Polishing Machines

Divine Brothers Co., Utica, N. Y., are the manufacturers of the DBX abrasive belt polishing machine.

The machine is built as a complete unit, with all the controls located at the front within easy reach so that it is never necessary for the operator to leave his position to make adjustments for belt tracking or tightening.

The upper control rotates the idler pulley, adjusting the tracking of the belt by aligning the wheels. The lower control conveniently adjusts the belt tension as required by moving a screw-operated counterweight. With this positive counterweighting, using no springs, the mechanism is so designed that there is no need for any belt tension device to ride on the coated face of the abrasive belt.

All moving parts are accurately machined to assure alignment, ease of adjustment and vibrationless operation. The idler pulley is mounted on sealed ball bearings which are lubricated at the factory for life and require no further attention. All models of DBX abrasive belt polishing machines are standard with right hand backstand and hood. A left hand backstand and hood can also be furnished to make both sides of the machine usable.

Manufacturers' Literature

Hydraulic Vane Pumps

Hydra-Motive Inc., 723 E. Milwaukee Ave., Detroit, Mich., have issued Bulletin Hy-2 discussing variable delivery hydraulic vane pumps which have standard mountings to permit them to be used as replacements for other pumps on existing equipment.

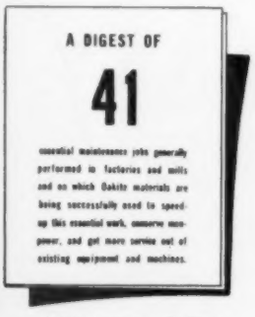
The bulletin contains an illustration of a portion of the type of Dual-Vane arrangement which, it is claimed, eliminates overheating, reduces wear and permits long period operation at excessive pressures.

Wartime Maintenance Digest

Oakite Products, Inc., 18 Thames St., N. Y. C., have issued an 8 page digest which concisely describes how new, time-saving cleaning materials, de-scaling methods and related techniques are helping metal-working plants solve the wartime problems of conserving manpower, shortening equipment shut-down time and stepping up efficiency in handling 41 vitally important, commonly recurring equipment maintenance, plant housekeeping and sanitation jobs.

Prepared in data sheet form for convenient, quick reference, this wartime maintenance guide outlines on each cleaning or related job discussed (1) the material used, (2) the method followed, (3) time saved, (4) fire or other hazards eliminated, and (5) other advantages gained essential to increasing operating efficiency as well as securing greater output and longer service from existing production, processing and power equipment and machines.

Copies are available free on request.



Maintenance Digest

Rosin Type Soap

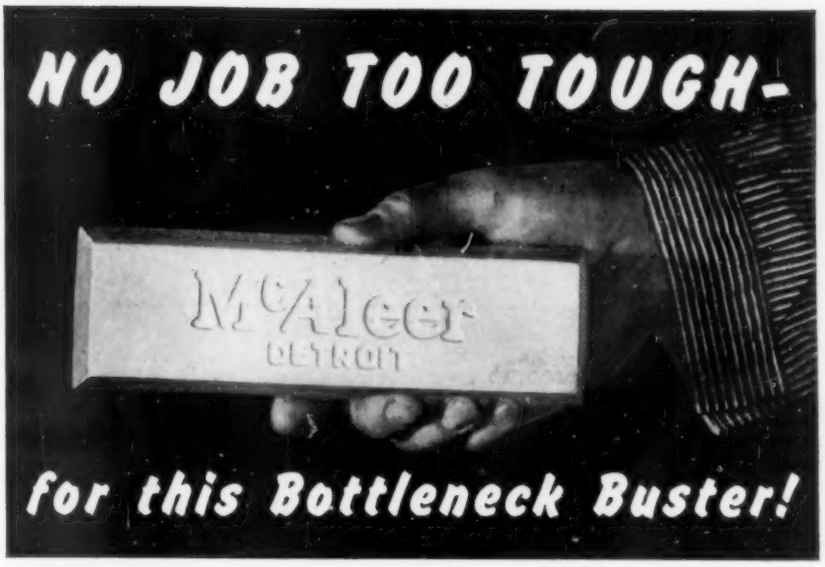
The first of a series of reports on the use of "Dresinate" in specific industries has been made in a booklet just issued by Hercules Powder Company for metal cleaning.

Dresinate, the neutral sodium salt of selected rosins, is described as a dry, free-flowing powder, with each particle water-soluble. Its uses for metal cleaning compounds are set forth in the booklet, which includes comparison tables and photographs of metal surfaces tested.

The laboratory photographs compare the action of Dresinate on metal with that of a standard cleaner, both in the electrolytic method and in a bath of alkaline solution at 90° C. for ten minutes. Other photographs compare the wetting action on powdered coal of a straight three per cent alkali (TSP) solution, as against the action of a Dresinate-fortified alkali.

The booklet, issued by the Paper Makers Chemical Department, explains that Dresinate, in its various types, produces rapid wetting of surfaces, emulsifies oils, greases, and other types of dirt removable with alkaline cleaners, and maintains the soil in suspension to assure a thorough rinsing action. It also makes possible a replacement of solvent baths by alkaline baths.

Ample supplies of Dresinate without present priority restrictions are said to be available.



● To win our share of this war we've got to tighten up—toughen up. We've got to funnel the work of three hours into one. Today production finishing requirements become more and more critical. The demand for speed and more speed becomes more insistent. That's why it is imperative to leave no stone unturned to find the finishing materials and methods that will push your production up to the peak you have to hit and keep it there.

It will pay you to learn why McAleer metal finishing materials and methods are performing such outstanding service for the leaders in your industry today—and, more important, how similar materials and methods can solve your metal finishing problems.

McAleer will work with you—recommend "tailored-to-fit-the-job" materials and methods—and then follow through as needed. The value of this service is already written in the finishing production records of many manufacturers who are working today under greater pressure than ever before. McAleer's Finishing Engineers and laboratory staff have helped them bust some pretty tough production bottlenecks . . . and usually with a plus of increased production, better finish and lower operating costs. It's the kind of a job we want to do for you.

McALEER

McALEER MANUFACTURING CO. • ROCHESTER, MICHIGAN

Carbon Brushes

The Keystone Carbon Co., Inc., Saint Marys, Pa., have issued a 24-page illustrated catalogue and price list on their line of metal-graphite and carbon-graphite brushes.

Slip-ring and commutator type brushes are shown and complete specifications of all types and price ranges are given.

Fire Extinguisher Maintenance

Pyrene Manufacturing Co., 560 Belmont Ave., Newark, N. J., have issued a new folder entitled "Directions for Inspecting, Recharging and Maintaining Portable Fire Extinguishers."

The folder may be obtained upon request from the company.

CLEANING ALUMINUM AND ALUMINUM ALLOYS

• **Wyandotte Research** has developed two degreasing and cleaning compounds for this sensitive metal, neither of which will attack or etch the metal in any manner.

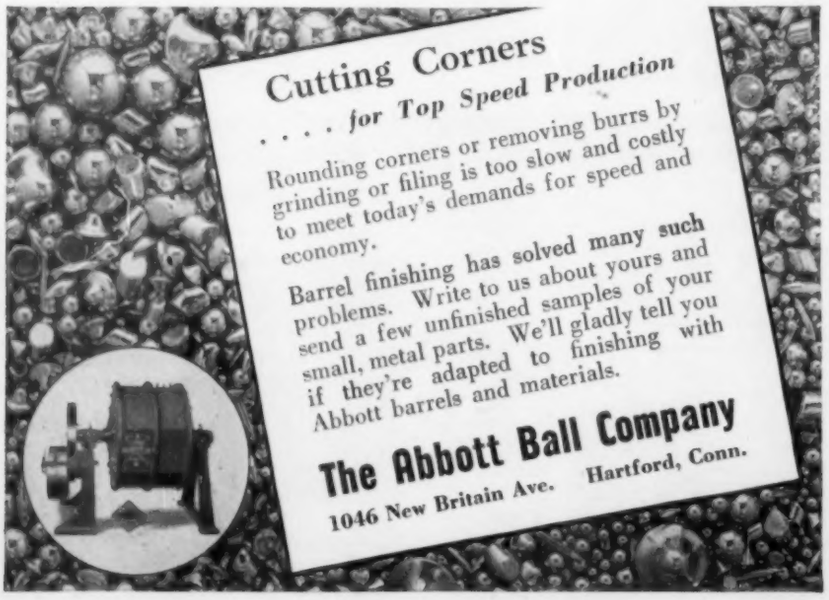
• **Wyandotte Light Alloy No. 1** — A powder (low in silicate) for cleaning prior to anodizing. Rapid in cleaning action. Triple A in rinsibility — equally applicable to castings, sheets, etc.

• **Wyandotte MK-50** — A liquid solvent detergent used in power washers for cleaning between machining operations and prior to inspection. It is neutral, and paint can be applied over it. From 50% to 60% less costly than chlorinated solvents.

• **Wyandotte Service Representatives** are skilled in solving cleaning problems of *all* kinds. They are constantly finding short cuts and helping to eliminate cleaning bottlenecks. A call for their assistance places you under no obligation.

Wyandotte
PRODUCTS
SERVICE REPRESENTATIVES IN 88 CITIES

THE J. B. FORD SALES COMPANY, WYANDOTTE, MICHIGAN


Cutting Corners
. . . . for Top Speed Production
Rounding corners or removing burrs by grinding or filing is too slow and costly to meet today's demands for speed and economy.
Barrel finishing has solved many such problems. Write to us about yours and send a few unfinished samples of your small, metal parts. We'll gladly tell you if they're adapted to finishing with Abbott barrels and materials.
The Abbott Ball Company
1046 New Britain Ave. Hartford, Conn.

Companies Engaged in Solvent Recovery Service

Due to the great interest in solvent recovery, we are publishing herewith a list of companies which, according to the Industrial Salvage Section, Conservation Division of the War Production Board, have facilities for reclaiming spent or contaminated solvents or oils:

California

Solvents Recovery Service
446 North Eucalyptus Ave.
Inglewood, Calif.

California Flaxseed Products Company
3135 East 26th St.
Los Angeles, Calif.

Leon Finch, Ltd.
728 East 59th St.
Los Angeles, Calif.

National Solvent & Aluminum Company
106 West College St.
Los Angeles, Calif.

S. P. Reclaiming Company
3540 Emery St.
Los Angeles, Calif.

Dorward & Sons Company
260 California St.
San Francisco, Calif.

Connecticut

Eastern Oil Refining Company
Wallingford, Conn.

Illinois

Standard Fruit Products Company
401 North Paulina St.
Chicago, Ill.

Indiana

American Chemical Service
95 Industrial Road
Hammond, Ind.

Hammond Chemical Service
241 Brunswick St.
Hammond, Ind.

Brace Engineering Co.
547 S. Belmont St.
Indianapolis, Ind.

Kansas

Noble Processing Company
320 Fourth National Bank Building
Wichita, Kans.

Kentucky

Kentucky Color & Chemical Company
600 North 34th St.
Louisville, Ky.

Massachusetts

Roblyn Oil Company
70-88 Freeport St.
Boston, Mass.

Pyrotex Leather Company
Leominster, Mass.

Woburn Degreasing Company
Woburn, Mass.

Michigan

Leslie Laboratories
Ann Arbor, Mich.

Dibble Color Company
1497 E. Grand Blvd.
Detroit, Mich.

Industrial Reclaimers Company
2827 Fort St. W.
Detroit, Mich.

U. S. Chemical Company
15444 E. Nine Mile Road
East Detroit, Mich.

Missouri

United Solvent Service Company
1100 Santa Fe St.
Kansas City, Mo.

New Jersey

Franco-American Chemical Works
Carlstadt, N. J.

Woburn Degreasing Company
Harrison, N. J.

Nord & Company
868 Broad St.
Newark, N. J.

Solvents Recovery Service
1019 Broad Street
Newark, N. J.

Yeast Products, Inc.
35 Eighth St.
Passaic, N. J.

New York

Glyco Products, Inc.
230 King St.
Brooklyn, N. Y.

Allen E. Rogers Corp.
Cooper Ave. & Dry Harbor Road
Glendale, L. I., N. Y.

Fulton Process & Chemical Corp.
97 Second St.
Gloversville, N. Y.

Triplex Oil Refining Company
37-80 Review Ave.
Long Island City, N. Y.

George T. Booth
76 Robinson St.
North Tonawanda, N. Y.

Condor Solvents
50 E. 41st St.
New York, N. Y.

In case there are any companies engaged in refining or reclaiming used industrial solvents which are not listed here, if they will kindly send us their names and addresses, we shall add them to this list.

Speed ACID PICKLING the DOUBLY SURE* Way with Enthone Acid Addition Agent

★ FASTER PICKLING — the acid rapidly penetrates under rust and scale, thus LIFTING THEM OFF!

★ SAVES ACID — Drag-out is materially reduced and acid is saved by inhibiting action.

OVERCOMES WATER-BREAK IN PICKLING — Due to poor alkaline cleaning or soap in the alkaline cleaner, water-breaks appear on acid dipping before plating. The use of ENTHONE AAA in the acid literally makes the acid a cleaner and overcomes peeling due to faulty cleaning.

Write today for FREE Trial SAMPLE and valuable informative BULLETIN

THE Enthone COMPANY
NEW HAVEN CONNECTICUT

McKeon's
"Liquid Sulphur"
TRADE MARK REG'D
STRIPS COPPER PLATING
after
SELECTIVE CARBURIZING
SULPHUR PRODUCTS CO. Greensburg, Pa.
(Service? Sure.)

There is no formation of "cement" coating around tanks and heating coils when Cowles PC Cleaner is used to clean aluminum for spot welding.

★**COWLES PC CLEANER** can be regulated to etch an aluminum surface in any degree from a mirror light "no-etch" to a caustic etch for painting, without subsequent pitting even after hours of exposure.

If you are cleaning aluminum for spot welding or any other purpose, write for our recommendations.

THE COWLES DETERGENT CO.
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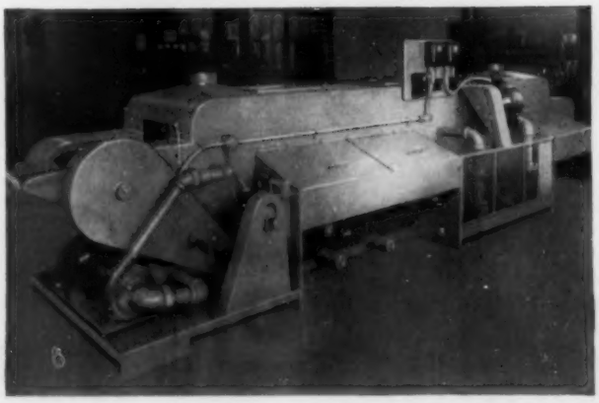

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Tin-Base Bearing Metals

The Tin Research Institute's publication No. 111 records a comprehensive study of the factors govering the adhesion of tin-base bearing alloys to various backing metals, including steel, bronze, copper, brass and cast iron. The results of this investigation were first reported in the *Journal of the Institute of Metals* Vol. 68, 1942, in a paper by W. T. Pell-Walpole, B.Sc., Ph.D., J. C. Prytherch, B.Sc. and B. Chalmers, D.Sc., Ph.D.

The conditions for obtaining efficient bonds are considered, and the many factors affecting these conditions in manufacturing operations are examined. Many tests are described which indicate the most suitable methods of preparing and tinning the bearing shell, and of casting and cooling the lining. The results of thousands of individual tests show the effects of variations in alloy composition, mould design, temperature of metal and mould, and rate and direction of cooling, in relation to both hand pouring and die-casting and also to centrifugal methods of production. The part played by shrinkage cavities at or near the bond is also examined, and methods of operation are suggested by which this trouble may be avoided.

Copies of this paper may be obtained free of charge from the Tin Research Institute, Fraser Road, Greenford, Middlesex.

Pressure Piping Code

The American Standards Association has announced approval of the 1942 revision of the American Standard "Code for Pressure Piping" (B31.1). The first edition of this Code was approved in 1935.

This standard covers power piping, gas and air piping, oil piping, district heating piping, refrigeration piping, fabricaton details, materials and identification.

New Books

Classified Directory. Seventh Edition. Association of Consulting Chemists and Chemical Engineers, Inc., 50 East 41st Street, New York. 1942-43. Size 8¼" x 10¾"; 54 pp. and appendices. Secured free of charge upon application to Association.

This directory describes the organization and services of consultants and consulting laboratories in the chemical field. It also discusses the Association itself—its purposes, by-laws and code of ethics.

In the main, however, the book is devoted to one-page statements by each member descriptive of the scope, functions, activities and qualifications of his organization as well as of himself.

Appended are geographical and alphabetical listings of the members. A featured supplement consists of the "key sheets" which make for easy reference by the type of work desired.

Structure and Properties of Alloys. By R. M. Brick and Arthur Phillips. Published by McGraw-Hill Book Company, Inc., 330 W. 42nd St., New York, N. Y. Size 6¼" x 9¼"; 227 pages. Price $2.50.

This book covers a narrow field of physical metallurgy and deals almost exclusively with the correlation of structures of metals and alloys with phase diagrams.

The tools required by the metallurgist are first discussed rather briefly. Following this, a chapter is devoted to commercially pure metals.

An outstanding feature of the book which should make the subject matter more readily understandable is the inclusion of many beautiful photomicrographs to illustrate the various features discussed in the text.

Plastic deformation is then given concise treatment. The balance of the book is concerned largely with individual alloys illustrating various phase structures. The copper nickel system is used to illustrate solid solutions. The lead-antimony system illustrates eutectic alloy formation with limited solid solubility.

The section on age hardening as noted, for example, with aluminum alloys is particularly good, and here again the use of clear photomicrographs adds materially to the understanding of the subject. The copper-zinc alloys are used to illustrate various phase transformations. Unfortunately, this chapter was given relatively scant treatment.

The balance of the book is devoted largely to iron-carbon alloys with only very limited attention to alloy steels. Monotectics such as copper-lead, silver-nickel and aluminum-cadmium are treated briefly.

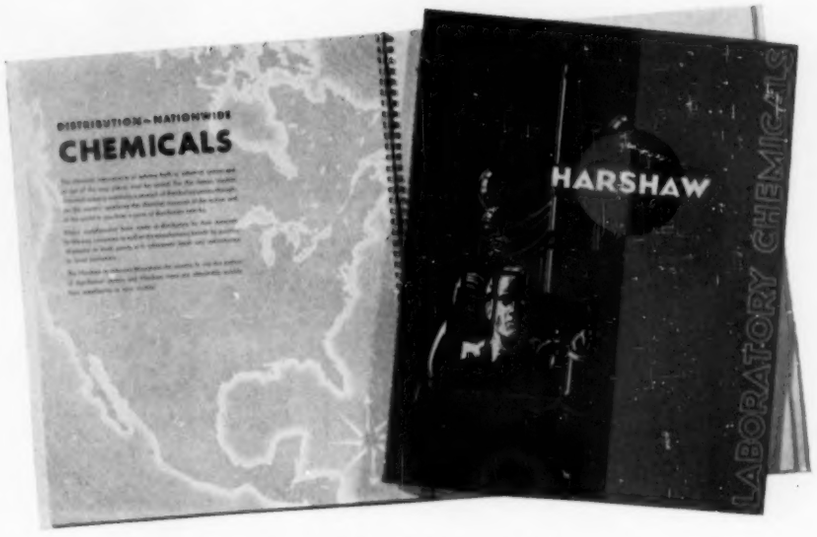
The book in the main is very well done but suffers in many spots from brevity and it is hoped that the authors may some day expand this treatment of alloys to publish a much needed comprehensive text on the subject. The book should fill a unique and valuable place in the literature of physical metallurgy.—W.R.M.

Electric Welding. By M. S. Matteson. 1942. Published by The Bruce Publishing Co., 540 N. Milwaukee Street, Milwaukee, Wis. Size 8⅜" x 11¾". 32 pages. Price 50c.

Mr. Matteson is an instructor in the Boys' Technical High School in Milwaukee and this presentation of his subject has the simple step-by-step form of a series of class lectures.

The book opens with a brief history of electric welding and some preliminary data. It then discusses welding in 24 separate units considering the elements of equipment, procedure and general information in each case.

Amply illustrated with diagrams and photographs, this book should prove as interesting a reference to the experienced operator as it is a text for the embryo welder.



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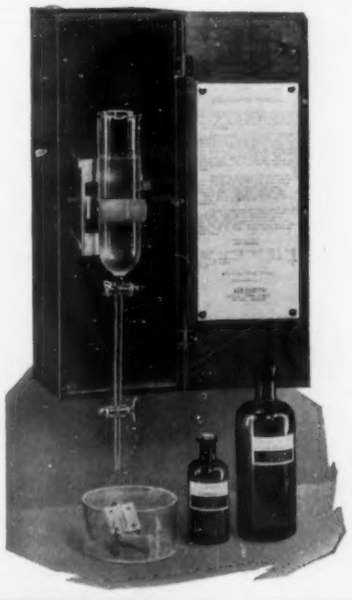

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Chemical Analysis of Aluminum by H. V. Churchill and R. W. Bridges. 2nd Edition. Size: 5¼" x 8¼"; 116 pages. Published by Aluminum Company of America, Pittsburgh, Pa. Price: 50c.

Methods for analysis of aluminum and aluminum alloys are brought up to date. Methods are given for determination of impurities, commonly alloyed elements, and less common elements such as antimony, beryllium, cerium, strontium, tantalum, uranium and vanadium.

Tin Solders. Second Edition. By S. J. Nightingale and O. F. Hudson. Published by Chemical Publishing Co., Inc., 234 King St., Brooklyn, N. Y.; 1942; 117 pages. Price: $2.75.

The first edition of this study of the properties of tin solders and soldered joints by Nightingale has been revised by Hudson to include later data, especially the results of some more recent research in Part I of the book. Part II is left substantially unchanged.

This edition includes the constitution of lead-tin and lead-tin-antimony solders, their structure and physical properties as well as the strength of various types of joints and the factors which affect them.

Part II, as in the first edition, deals with practical soldering, the choice of solders and solder specifications.

Grinding Instruction Aids

Norton Co., Worcester, Mass., have published a colored leaflet entitled "The 'Know How' of Grinding" which is descriptive of their instruction aids for grinding operations.

The seventeen different booklets dealing with the various phases of grinding which may be secured through the company are discussed. The special motion picture series and the week-long practical instruction course, both of which also are available free of charge are discussed.

A coupon suitable for ordering these services as well as "Grits and Grinds", a monthly magazine, is provided.

Cleaning Compounds

Magnuson Products Corp., 50 Court St., Brooklyn, N. Y., have issued a folder illustrating the use of "Permag" cleaning compounds in many industries.

A resume of typical cases handled by their service specialists is included.

Polishing and Buffing Wheels

The Matchless Metal Polish Co., 844 W. 49 Place, Chicago and Glen Ridge, N. J., have issued a 28-page catalogue of polishing and buffing wheels. Bobs, buffs, bushings, discs, flanges, glue, leather items, polishing wheels, rakes, shapes and spacers are considered.

Associations and Societies

Electrochemical Society

The Electrochemical Society, Inc., announces future meetings as follows: *Pittsburgh*, April 7, 8, 9 and 10, 1943. Topics: "Automatic Control of Industrial Processes" and "Dielectrics". *New York City*, October 13, 14, 15 and 16, 1943. Topics: "Electro-Organic Chemistry" and "Unusual Procedures in Electroplating." *Milwaukee*, April 12, 13, 14 and 15, 1944.

American Electroplaters' Society

Methods for securing a good bond between the coating applied by the painter and the coating applied by the plater were discussed in an extemporaneous talk delivered at the November 11 meeting of Los Angeles Branch, AES, by *Harold Acker*, chief chemist, *W. P. Fuller Co.*, Los Angeles.

Mr. Acker stated that the difficulties usually encountered with a finish are in direct ratio to how the surface has been applied. Referring to the treatment of dissimilar metals, he declared that the aircraft industry is a notable example of an industry which has made considerable progress in the proper treatment of dissimilar metals.

He reviewed the progress which has taken place since the aircraft industry in 1929 began moving away from the use of wood in preference to metals. The speaker also discussed the aircraft industry's practices for protecting aluminum with anodizing and the trend from cadmium to zinc, wherever practical.

"Paint materials are actually organic coatings," said Mr. Acker. "The painter and the electroplater must cooperate effectively in the future. This is imperative. If they do so, progress in metal finishing will be attended by fewer difficulties than in the past."

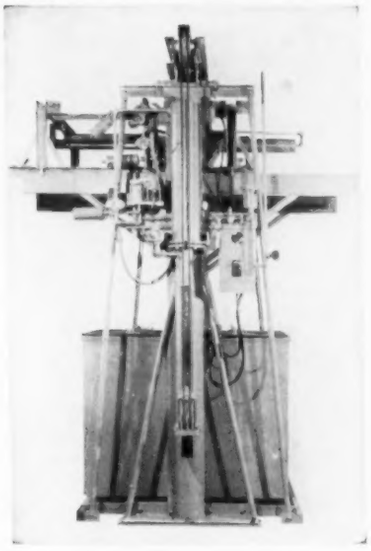
In conclusion the speaker touched upon the amazing developments which have occurred in the plastics field during the past year, or, roughly, since the outbreak of war with Japan. He predicted that some phases of developments in the plastics industry will inevitably find an echo in the finishing field; plastic plating, for instance.

A general discussion of the advantages and disadvantages of bright dipping following cadmium was held after the main talk had been concluded.

Fred Maurer, who as process engineer for the *General Electric Co.* in Ontario, Calif., presented several excellent technical papers before the branch in recent years, gave a brief talk on the functions and duties of the Plant Protection Division of the Chemical Warfare Service, with which he now is serving as a first lieutenant.

Branch President *Emmette R. Holman* appointed *Marcus Rynkofs* to serve as chairman of the arrangements committee for the 1943 annual educational session which—gas rationing, tire shortages and other wartime factors permitting—will be held some time in March, probably at the Los Angeles Breakfast Club.

Crown Pick-up Unit



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A. J. Hereford, Glenn Bldg., Atlanta, Ga.
Wm. H. Price, Jr. (Divisional Mgr.), 2908 Rising Sun Rd., Ardmore, Pa.

News From California

By Fred Herr

Tom F. McGuire, sales engineer for *Maas & Waldstein's* Pacific coast branch for the past 15 years, has transferred to the *Andrew Brown Co.*, lacquer firm, 5431 Riverside Drive, Los Angeles, where he is serving as a process engineer.

Bruno H. Schindler, former plating room superintendent for the *Weiser Manufacturing Co.*, hardware specialty makers, is now foundry superintendent for the *Studebaker Corp.*, at Los Angeles.

Marcus Rynkofs, president, *Liberty Plating Co.*, 525 North LaBrea Ave., Los Angeles, suffered a heart attack on November 14 which necessitated a reduction of the somewhat strenuous sshedule under which he has been operating recently. Mr. Rynkofs' efficient staff is composed of his wife, Mrs. Mary Rynkofs, who handles the office, and his son, Stanley, who is the plating shop superintendent.

This company is doing considerable finishing of plumbing items for housing projects built for Henry Kaiser's $20,000,000 steel mill at Fontana, Calif. Much of the work involves chromium plating directly on brass.

George and *Isadore Familian* have established the *Pacific Gray Iron Casting Co.* at 9430 Rayo Ave., South Gate, Calif.

Clarence E. Thornton, Los Angeles branch manager for the *Chas. F. L'Hommedieu & Sons Co.*, and Mrs. Thornton, returned early in November from a three weeks' business and pleasure trip to Chicago, Ill., and Muncie, Ind.

Southwestern Chemicals Co. has been established at 2400 North Alameda St., Compton, Calif., by *Oscar V. Burris.*

The *E. W. Sargent Engineering Co.* and *HLH Precision Parts, Inc.*, which formerly operated individually, have been consolidated under the name of *HLH Precision Parts*, under the management of *Hugh Hill* and *Henry J. Hutchings.* The plant is at 1263 N. Western Ave., Los Angeles.

Arrangements for operation of a new firm under the name of *Micro-Machine Products Co.* have been completel by *John K. Venard* and *Harry Kolmanson.* Headquarters and plant are at 4116 Tivoli Ave., Los Angeles.

Gene Rynkofs of the Rynkofs plating clan in Los Angeles, now a marine, won second place in a service sharpshooting contest, turning in a score of 320 bullseyes out of a possible 340. Gene's company sergeant placed first with 321.

Fred Maurer, process engineer for the *General Electric Co.'s* Hotpoint plant at Ontario, Calif., has been appointed a first lieutenant in the Chemical Warfare Service. He is attached to the Plant Protection Service, Ninth Service Command, southern district, headquarters for which are at Fort Douglas, Utah. Lieutenant Maurer currently is stationed in Los Angeles and took advantage of the opportunity to attend the November meeting of the Los Angeles AES.

Los Angeles Research Laboratories, 5359 W. Adams Blvd., have received papers of incorporation. Members include *Charles B. Codding, S. L. Martinez, A. E. Manson* and *G. F. Meiser.*

Edward Tobiasson early in November opened the *Midway Stamping and Die Works* at 2442 Santa Monica Blvd., Santa Monica, Calif.

Theodore G. Coyle, technical director, *United Chromium, Inc.*, Detroit, Mich., attended the November meeting of the Los Angeles Branch, AES.

The Black Mountain Chrome Co. has been established at Fresno, Calif. by *W. C. Hodges* and *S. A. Leonard.*

Belke dipping baskets are rigid and sturdy in construction — can be furnished in steel, brass, monel metal or Ni-Chrome in any mesh or size.

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Sarco self-operated temperature regulators provide gentle, throttling control of the steam supply to maintain desired temperatures within close limits.

Use this team for hot water generators, blast or unit heaters, and all types of process equipment where constant temperatures are important and the steam loads are heavy. Catalogs 450 and 600.

TR-21 Regulator 149

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475 Fifth Avenue, New York, N. Y.
Sarco Canada Ltd., Federal Bldg., Toronto, Ont.

The Palace Plating Co., which is operated by *Earl Coffin* at 710 East 29th St., Los Angeles, is busy these days on war contracts, mainly polishing aluminum castings for aircraft production which are delivered to the shop directly from the foundries.

Ray Vasquez, Jr., son of Coffin's shop foreman, was the latest to leave for the war, joining the Navy early in November.

The plating and finishing department of the *F. E. Olds Band Instrument Co.* of Los Angeles has obtained an Army contract for plating 1800 band horns, including trumpets and cornets.

The vital role that industrial chemistry plays in the war was presented by the above float in the Navy Day Parade in Philadelphia. Products of Pennsylvania Salt Manufacturing Co. were displayed in a pyramid topped by a six-foot model of a Navy bomber.

Business Items

Earl H. Seelbach, Box 56, Kenmore Station, Buffalo, N. Y., now represents the company for the sale of heat treating products and allied materials in the territory west of Syracuse to Buffalo, and including Ontario, Canada. Mr. Seelbach has represented Marr Furnace Company of Minneapolis in this area for many years and is well known in the heat treating field.

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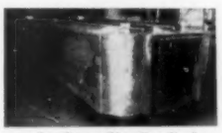

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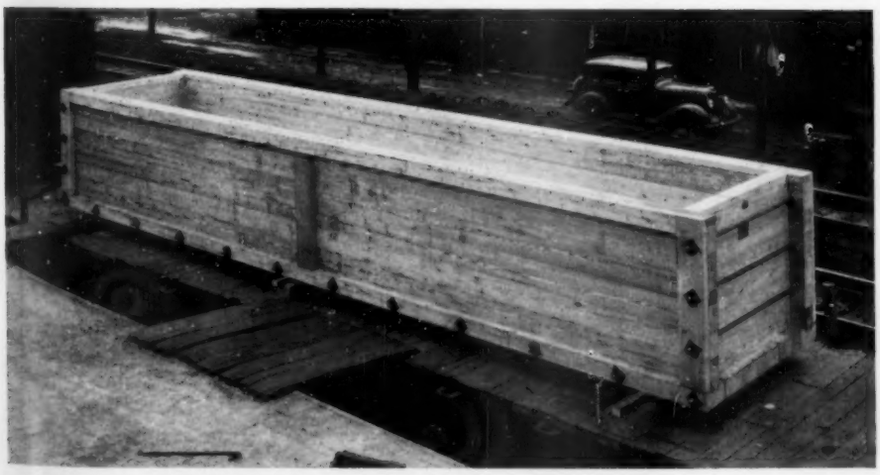

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Dr. Walter R. Meyer

Dr. Walter R. Meyer to Direct Enthone's Research

Dr. Walter R. Meyer has become Technical Director of *The Enthone Company*, New Haven, Conn. He will direct the development of new products and processes for the metal finishing industry as well as assist in problems attendant with the application of the company's products in the finishing of war goods.

Dr. Meyer received his B.S. in chemistry from Sheffield Scientific School of Yale University in 1928, and his Ph.D. in 1938 from the Dept. of Metallurgy, School of Engineering of Yale University.

From 1929 to 1931 he was plant chemist of Sargent & Co., New Haven, Conn., and from 1931 to 1938, he was electrochemist and metallurgist of the General Electric Co., Bridgeport, Conn. For the past four years he was Editor of *Metal Finishing* magazine and Editor of four editions of "Plating and Finishing Guidebook".

Dr. Meyer is widely known about the country for his many technical papers and lectures and is a member of The Electrochemical Society, American Electroplaters' Society, Electrodepositors Technical Society (England), Faraday Society, American Society for Metals and Sigma Xi.

The Watson-Standard Company, Pittsburgh, Pa., makers of paints, industrial finishes and protective coatings, have announced the appointment of *H. A. Erickson* as sales engineer in charge of industrial technical service in northwestern Pennsylvania and central and western New York.

Mr. Erickson, whose headquarters will be located at 148 Newton Ave., Jamestown, N. Y., (phone Jamestown 53645), was formerly with the *Marietta Paint & Color Co.*

C. H. Mathewson of New Haven, Conn., has been elected President of the American Institute of Mining and Metallurgical Engineers. Dr. Mathewson is Professor of Metallurgy and Chairman of the Department of Metallurgy, Yale University. Election was by letter ballot of 12,000 members, the report of the tellers having been made at a meeting of the Board of Directors of the Institute held last night at its headquarters in the Engineering Societies Building, New York City.

At the annual meeting of the American Die Casting Institute, Inc., held on November 18th at the Hotel Cleveland, Cleveland, O., *A. F. Waltz*, President of *Advance Pressure Castings, Inc.*, Brooklyn, N. Y., was elected President of the Institute for the next fiscal year. *H. H. Weiss*, President of *Superior Die Casting Co.*, Cleveland, O., was elected Vice President.

Floyd Todd has joined the laboratory staff of *Quaker Chemical Products Corporation* of Conshohocken, Pa., in a research capacity. His initial work will be in the field of metal corrosion.

Mr. Todd, who received his M.S. degree at Cornell University, has been connected in the past with the Atlantic Refining Company and Sharp & Dohme Company.

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Divine Brothers Receive "E" Award

At a special ceremony on November 12th, the employees and management of *Divine Brothers Co.*, Utica, N. Y., were awarded the Army-Navy Production "E". Divine Brothers Co. are manufacturers of abrasive finishing equipment.

George A. Lennox, Assistant Sales Manager, has been appointed General Sales Manager of the *Driver-Harris Company*, Harrison, N. J., manufacturers of special alloys.

Mr. Lennox has been with the company since 1907 and became District Sales Manager of the Chicago territory in 1917 and from that position was appointed Assistant Sales Manager.

Park Chemical Co. announces the appointment of *Fred W. Reiber* to represent them on grain cement problems.

Mr. Reiber has had many years of experience in polishing room problems. His headquarters will be at 165 Claremont Ave., N. W., Canton, Ohio.

Announcement is made by *The Curran Corporation*, Malden, Mass., of the opening of a new war products development laboratory to be located in the Processing Plant, Prospect Mills, Lawrence, Mass. It is stated that the purpose of the laboratory is to put its creative chemists on the development of both offensive and defensive war chemicals.

Keystone Carbon Company, Saint Marys, Pa., announces the appointment of *George B. Shaw* as Sales Engineer. Mr. Shaw is a graduate of St. Francis College and is devoting his efforts to promotion of the company's negative temperature coefficient resistance material which is a recent development of the company.

George B. Shaw

Andrews & Evans Plating Co. announce the removal of their office and shop to 422 South West Street, Syracuse, N. Y.

Park Chemical Company, Detroit, Mich., announce the following additions to their service organization: *Charles R. Foreman*, formerly in the metallurgical department of Oldsmobile at Lansing, Mich., is now a member of the company's metallurgical department.

F. V. Lindsey, Official of Driver-Harris Company, Dies

Frederick Van Voorhees Lindsay, Vice President and General Sales Manager of the Driver-Harris Company, Harrison, N. J., died November 16th, 1942 at the Memorial Hospital, New York City after a brief illness.

Mr. Lindsey was born in Streator, Illinois, but resided in Chicago until 1916 when he moved to Morristown, N. J., where he became associated with the Electrical Alloy Company, as Vice President and General Manager. In 1925, when the Electrical Alloy Company was absorbed by the Driver-Harris Company he was elected Vice President and General Sales Manager.

Mr. Lindsey was a member of the Essex Club of Newark, N. J., the Manufacturers' Club of West Hudson, the Bay Head Yacht Club and associated member of the National Electrical Manufacturers Association.

Surviving are his widow, Mrs. Margaret Lindsey, a son, Lt. Frederick V. V. Lindsey, Jr. of the Armored Force School, Fort Knox, Kentucky and a brother, Walter Lindsey of New York.

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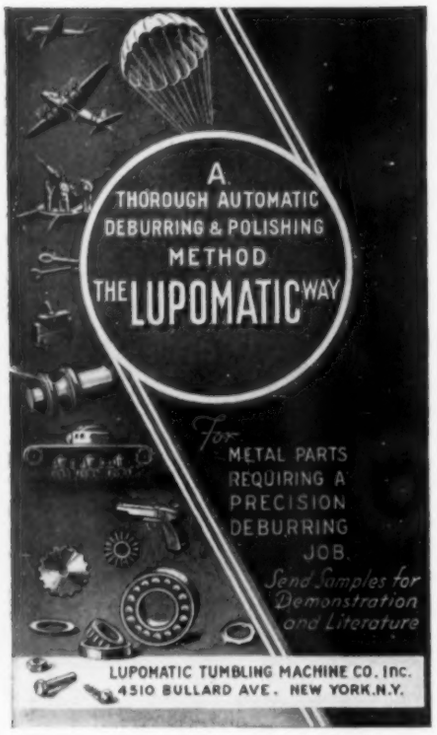

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